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URANIUM POTENTIAL OF PRECAMBRIAN ROCKS IN THE RAFT RIVER AREA OF NORTHWESTERN UTAH AND SOUTH-CENTRAL IDAHO.

FINAL REPORT

MEIIJI RESOURCE CONSULTANTS

SEPT. 1980

PREPARED FOR U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
Grand Junction Office , Colorado

This report is a result of work performed by Meiiji Resource Consultants, through a Bendix Field Engineering Corporation Subcontract, as part of the National Uranium Resource Evaluation. NURE is a program of the U.S. Department of Energy's Grand Junction, Colorado, Office to acquire and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence or uranium in the United States.

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FINAL REPORT

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CONTENTS

Page

ILLUSTRATIONS

TABLES

PLATES

URANIUM POTENTIAL OF PRECAMBRIAN ROCKS IN THE RAFT RIVER AREA OF NORTHWESTERN UTAH AND SOUTHCENTRAL IDAHO

Abstract

Precambrian quartz-pebble conglomerates host important uranium deposits in Canada and South Africa. Application of the information and ideas gained from studies of these type areas resulted in the discovery of potentially significant uranium mineralization in certain Precambrian metasedimentary rocks in Wyoming and South Dakota. A preliminary literature study and one-day field visit by BFEC and USGS geologists prompted selection of the Elba and Yost Quartzites and Archean metasedimentary rocks for evaluation. Accordingly, a study of the Raft River area was undertaken in support of the National Uranium Resource Evaluation (NURE) program to evaluate the potential of these Precambrian W and X (?) metasedimentary units to host Precambrian quartz-pebble conglomerate uranium deposits.

Considerations of access, relief, available time, season, stratigraphic and structural complexities, and generally poor exposures of rocks followed field reconnaissance, radiation measurements, and geochemical sampling as the most cost effective methods for a timely evaluation of uranium potential. A total of 1214 geochemical samples were collected and analyzed. The sampling media included 334 waters, 616 stream sediments, and 264 rocks. In addition, some stratigraphic sections of Elba and Yost Quartzites and Archean metasedimentary rock were measured and sampled and numerous radiation determinations made of the various target units.

Statistical evaluation of the geochemical data permitted recognition of 156 uranium anomalies, 52 in water, 79 in stream sediment, and 25 in rock. Geographically, 68 are located in the Grouse Creek Mountains, 43 in the Raft River Mountains, and 41 in the Albion Range. Areal distribution of the geochemical anomalies of uranium reveals a conspicuous preference for certain lithostratigraphic units, and 125 of the uranium anomalies occur in samples obtained from Precambrian W and X (?) lithologies.

Interpretation of the various data leads to the conclusion that uranium anomalies relate to sparingly and moderately soluble uraniferous heavy minerals, which occur as sparse but widely distributed magmatic, detrital, and/or metamorphically segregated components in the target lithostratigraphic units. The uraniferous minerals known to occur and believed to account for the geochemical anomalies include allanite, monazite, zircon, and apatite. In some instances samarskite may be important. These heavy minerals contain uranium and geochemically related elements, such as thorium, cerium, yittrium, and zirconium, in sufficient quantities to account for both the conspicuous lithologic preference and the generally observed low amplitude of the anomalies.

The various data generated in connection with this study, as well as those available in the published literature, collectively support the conclusion that the various Precambrian W and X (?) lithostratigraphic units pre-selected for evaluation probably lack potential to host important Precambrian quartz-pebble conglomerate uranium deposits. Moreover, it is also doubted that they possess any potential to host Proterozoic unconformity-type uranium deposits. The data suggest a possibility of hydrothermal vein, or very weakly disseminated uranium mineralization, in certain areas where geochemical and airborne radiation anomalies, with

with or without associated sulfide mineralization, sodium metasomatism, or two-mica adamellite, correspond to exposures of Precambrian W or X (?) target units. Prospective areas for this type of mineralization potentially include the mantled gneiss dome in the central Grouse Creek Mountains, the areain between the Left Hand Fork of Johnson Creek and Charleston Creek, the Century Hollow and Ashbrook mining districts, the Upper Narrows area, and the Cedar Hills area. All are considered relatively remote prospects, but field checking of these areas is justified and recommended as a precautionary measure. Within the time and budget constraints imposed by the primary study objectives, it was not possible to investigate or sample the Paleozoic and Tertiary rocks. An objective appraisal of their uranium potential is therefore lacking, although both are considered to have some, albeit largely unknown, potential to host hydrothermal vein, contact metasomatic, volcanogenic, carbonaceous shale and lignite, and sandstone type uranium deposits.

INTRODUCTION

Purpose and Scope

This study was conducted in support of the National Uranium Resource Evaluation (NURE) program, specifically the World Class Studies (WCS) program element. NURE is a U.S. Department of Energy program managed by the Grand Junction Office. Its purpose is to acquire and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States. The WCS program objective, insofar as it relates to this study, is to evaluate the uranium potential of selected areas in the United States for major (World Class) non-sandstone uranium deposits similar to those recognized in foreign countries.

Uranium-bearing quartz-pebble conglomerates of Early Proterozoic age account for 17 percent of the non-communist world uranium reserves available at $30 per pound or less (Chenoweth, 1977). Important deposits occur in the Witwatersrand area, South Africa, and the Elliot Lake-Blind River region, Ontario (fig. 1). Application of the ideas and information gained from extensive studies of these type areas has resulted in potentially significant discoveries of uranium-bearing metasedimentary rocks in the Medicine Bow - Sierra Madre Mountains of Wyoming by Graff and Houston (1977) and in the Black Hills of South Dakota by Hills (1977). Recognition of uraniferous conglomerate and quartzite in the metasedimentary sequences of these two areas prompted Bendix Field Engineering Corporation (BFEC) to initiate reconnaissance studies in other areas of the Wyoming

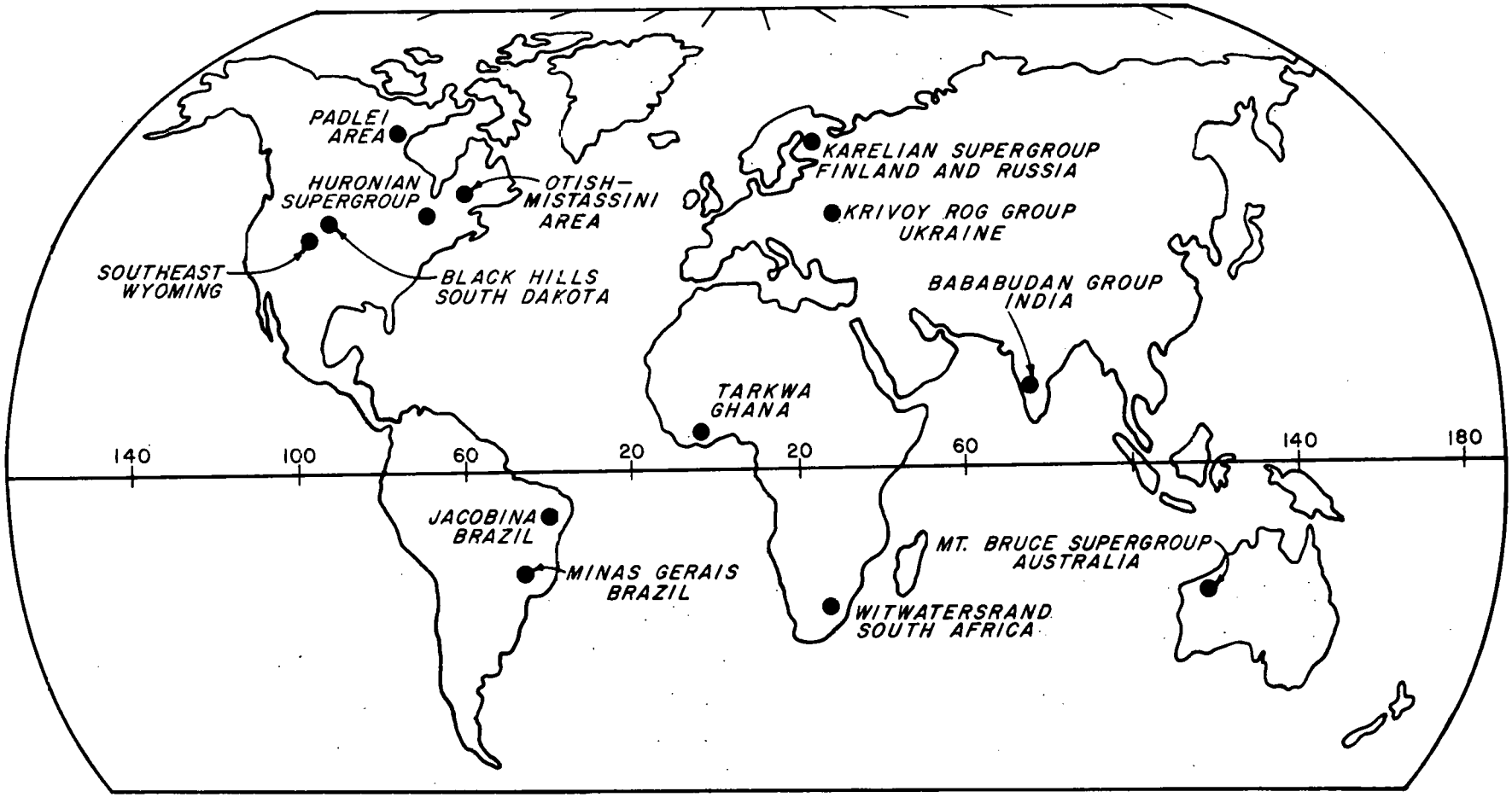


FIGURE 1. World-wide distribution of Early Proterozoic-type fossil placer uranium and gold occurrences.
(Modified after Houston and Karlstrom, 1980)

Precambrian Province deemed favorable for the occurrence of radioactive-metasedimentary sequences. Selection of areas for reconnaissance was based on three criteria, notably (1) the presence of Late Archean and/or metasedimentary rocks, (2) the presence of a profound regional unconformity between the Archean basement rocks and the overlying metasedimentary rocks, and (3) the presence of Precambrian pebble conglomerate and/or quartzite units similar in character to those of the type areas.

A preliminary literature study by BFEC and a one day field visit by BFEC and USGS geologists indicated that the Raft River, Grouse Creek, and Albion Ranges contain Precambrian rocks that generally meet the selection criteria. Subsequently, Meiiji Resource Consultants was awarded a BFEC subcontract (contract BFEC-GJO-RFP-0214) to evaluate the Precambrian quartz-pebble conglomerate uranium potential of the metasedimentary rocks overlying and underlying the profound regional unconformity that is present in the Raft River, Grouse Creek, and Albion Ranges. A secondary objective was to assess the regional unconformity for Proterozoic unconformity-type uranium deposits which account for 18 percent of the non-communist world uranium reserves available at $30 per pound or less (Chenoweth, 1977).

This study is only one of several BFEC has initiated to assess metasedimentary sequences in the United States for their Precambrian quartz-pebble conglomerate uranium potential (fig. 2). Insofar as the writer is aware, the Raft River area has never been investigated from the perspective that its Proterozoic (Precambrian X ?) and Archean (Precambrian W) metasedimentary rocks might host quartz-pebble conglomerate and/or Proterozoic unconformity-type uranium deposits.

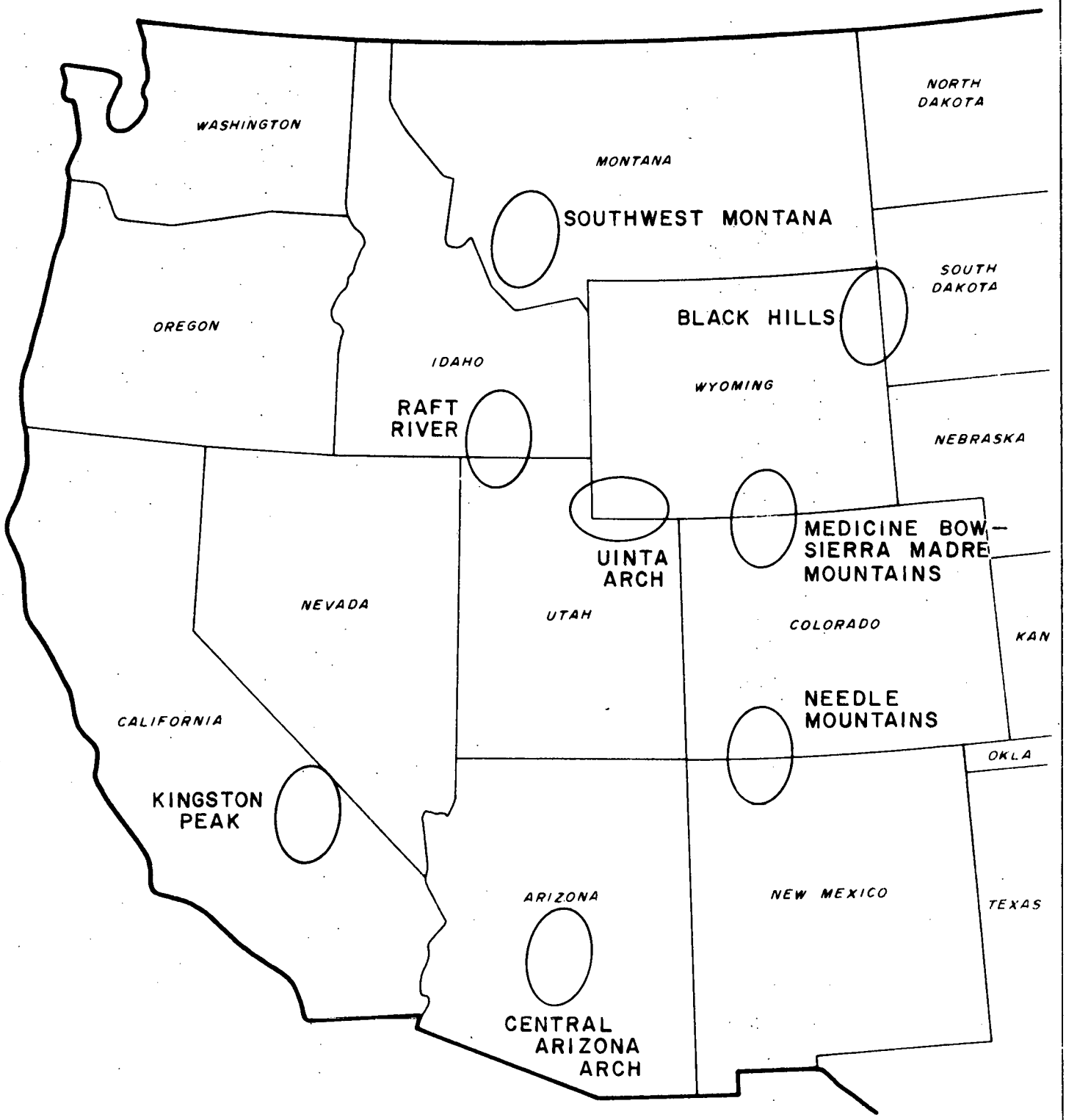


FIGURE 2. Areas in which BFEC has initiated field studies to evaluate metasedimentary sequences for their Precambrian quartz–pebble conglomerate uranium potential.

This report presents the data, observations, and interpretations of an areal geochemical sampling program undertaken to evaluate the uranium potential of conglomerates, quartzites, and the profound regional unconformity within the older Precambrian metasedimentary rocks of the Raft River and Grouse Creek Mountains of Utah and the Albion Range of Idaho. Specific stratigraphic and structural entities chosen for evaluation were pre-selected by BFEC on the basis of a literature study and field visit and include, in order of decreasing priority: (1) quartzite and conglomerate facies of the Green Creek Complex, (2) conglomerate facies and paleoregolith of the Elba Quartzite, and (3) conglomerate facies of the Yost Quartzite.

Considerations of access, relief, climate, available time, season, stratigraphic and structural complexities, and generally poor exposure of rocks in the area resulted in the selection of field reconnaissance, radiation detection, and geochemical sampling as the most cost-effective method of accomplishing a timely evaluation of uranium potential. Accordingly, field observations and sampling necessarily emphasized areas underlain by potential host rocks.

Location, Access, and Relief

The project area, or the Raft River area as it is commonly designated in literature, includes approximately 700 square miles in northwestern Utah and adjacent south-central Idaho (fig. 3). It comprises the northwestern part of Box Elder County, Utah and the adjacent central part of Cassia County, Idaho. Better exposures of the Precambrian target units

Sketch map of the major geological elements of the northeastern Great Basin.

Mesozoic metamorphic terrane is shown by dot pattern.

1 = Pioneer Mt.,
2 = Raft River complex,
3 = Dugway Proving Ground
4 = Pilot Range
5 = Ruby Mt. area
6 = Egan and Cherry Creek Mt.
7 = Schell Creek Mt.
8 = Snake and Deep Creek Mt.
9 = Grant Range

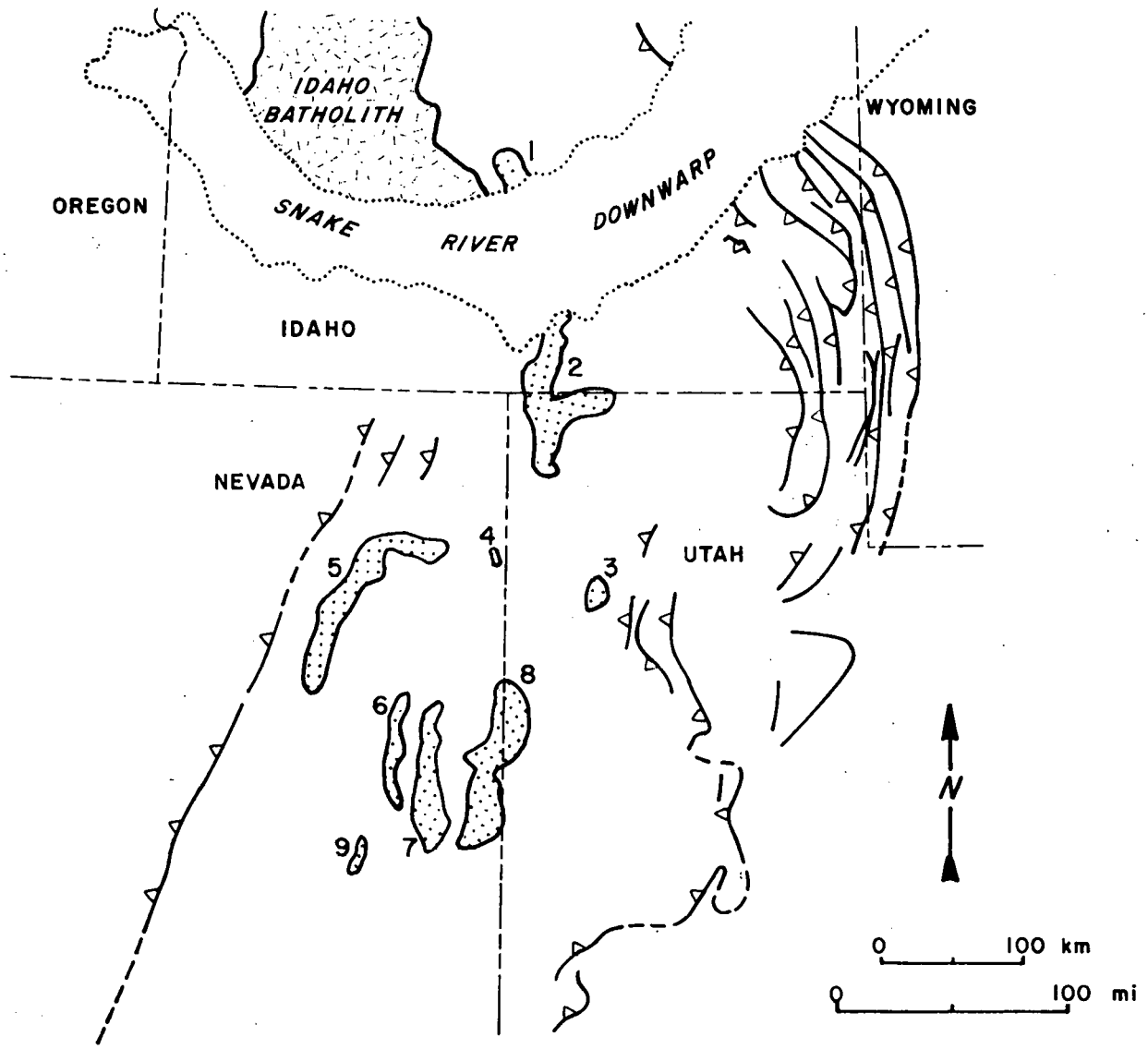


FIGURE 3. LOCATION AND GEOLOGIC SETTING OF RAFT RIVER STUDY AREA
(From Miller, 1978)

occur within the domal uplifts of the Raft River, Grouse Creek, and Albion Ranges. Precambrian rocks underlie approximately 50 percent of the study area (plate 1).

Access is moderately good. No point within the area is more than a few miles horizontally and a few thousand feet vertically from roads or trails passable with a four-wheel-drive vehicle. Withdrawals of some Sawtooth National Forest lands in the Albion Range, and private land ownership with restricted access in the Raft River and Grouse Creek Mountains, hampered field observations and geochemical sampling. The most noticeable effect of the restricted access is seen in the sample coverage in the southeast part of the Raft River Mountains (plates 2-4). The lack of samples from this area of spectacular exposures of Precambrian stratigraphy and isoclinal folds, however, did not detract from the evaluation of uranium potential because the local geology is the same as that of the adjacent areas with adequate sample coverage. Other effects of restricted access include lower productivity of sampling crews (and attendant higher costs) and a slightly less dense sample coverage than BFEC originally estimated.

Relief is highly variable in the project area, locally exceeding 1524 meters (5,000 feet) in the Albion and Raft River Mountains. Most of the valleys have elevations between 1524 and 1676 meters (5,000 and 5,500 feet), whereas some mountain summits exceed 3048 meters (10,000 feet). The line of demarcation between mountains and valleys corresponds closely to the 1829 meter (1600 foot) contour.

The effects of glaciation during the Pleistocene are conspicuous at the higher elevations where U-shaped valleys, cirques, tarns, and moraines occur. The mountain ranges are deeply dissected. Slopes are

typically steep and covered with talus and flora which mask bedrock exposures. Outcrops are found at the heads of cirques or canyons, but these precipices preclude observation or sampling except by mountain climbers.

Typical Basin and Range physiography is well developed in the study area. The valley flora is dominated by sagebrush and grasses with juniper around the periphery, whereas the mountain flora consists of aspen, pine, and mountain mahogany.

Previous Work

A variety of geologic studies have been conducted in the Raft River area in the past 100 years since geologists of the King survey first noted granitic and metamorphic rocks in the area (Hague and Emmons, 1877). Early reports deal mainly with descriptions of small-scale mining activities (MacFarren, 1909; Higgins, 1909), mineral resources (Butler, 1920), ground water resources (Piper, 1923), and general geology (Anderson, 1931, 1934).

Anderson's (1931, 1934) pioneering effort is significant because he was the first to map and describe, in some detail, the geology of the Albion Range. He proposed the name Harrison Series for the metasedimentary sequence (later renamed Albion Range Group, Anderson, 1934), suggested granitization as the process whereby the Cassia batholith of Mesozoic age was formed, and interpreted the Cassia batholith and Harrison Series to be thrust over unmetamorphosed rocks (Anderson, 1931). As expected, these early investigations were necessarily reconnaissance in nature.

During the next 20 years little interest was shown in the Raft River area. Then in the early 1950's and mid-1960's, perhaps in response

to renewed interest in the petroleum and mineral potential of the Great Basin, academicians, their students, and U.S.G.S. researchers commenced fundamental field studies in the area. Their efforts were an attempt to unravel a number of structural, stratigraphic, and geochronologic problems resulting from multiple deformations involving both regional and contact metamorphism, thrusting, and plutonism of rocks in the area. Stokes (1952) was apparently the first of these to make detailed observations in the study area. He described a Precambrian granitic basement complex unconformably overlain by metamorphosed Cambrian (?) quartzite, conglomerate, and sandstone, which in turn was overlain unconformably by unmetamorphosed Pennsylvanian rocks.

Subsequent mapping by Felix (1956) resulted in his recognition of Stokes' Cambrian (?) - Pennyslvanian contact as a thrust fault. The major contributions of Felix (1956) were his geologic map, which was reasonably accurate for the distribution of major rock types; his recognition of a lower to middle Paleozoic carbonate and quartzite sequence in fault contact with higher grade metamorphic rocks also of Paleozoic age; and his recognition of the metamorphism of the lower part of his Paleozoic section. Felix erred, however, by failing to recognize the Precambrian - Cambrian (?) unconformity of Stokes and by assigning a Mesozoic age to the Precambrian granitic basement rocks, designated by Felix (1956) as the Raft River stock.

During the late 1950's, geologists focused renewed attention on the Precambrian rocks of northwest Utah and south-central Idaho. Regional stratigraphic, structural, and metamorphic studies were conducted in the Great Basin, the more important being those of Hazzard and Turner (1957), Misch (1960), and Misch and Hazzard (1962). In conjunction with

their regional studies, Hazzard and Turner (1957) recognized a major decollement thrust separating unmetamorphosed Paleozoic rocks from underlying metasedimentary and Precambrian crystalline rocks in the Raft River, Grouse Creek and Albion Ranges and interpreted this thrust to have regional extent and a mid-Mesozoic age. This early work also prompted interpretation of the regional metamorphism to be of Precambrian age (Misch and others, 1957).

Subsequent observations by Misch and Hazzard (1962) led them to designate the Raft River stock of Felix (1956) and the Cassia batholith of Anderson (1931) as Precambrian in age. They also interpreted the contact between units A and B of Felix (1956), which correspond to the Precambrian-Cambrian (?) unconformity of Stokes (1952), to be a metamorphically deformed unconformity. Misch and Hazzard (1962) emphasized the division of metamorphic rocks in eastern Nevada, western Utah, and south-central Idaho into an older crystalline basement complex overlain unconformably by metasedimentary rocks of late Precambrian or early Paleozoic age. Additional contributions of Misch (1960) and Misch and Hazzard (1962) include recognition of only one episode of regional metamorphism of the conformable late Precambrian-Paleozoic-early Triassic succession, systematic increase of metamorphic grade with increasing stratigraphic depth, synkinematic (synorogenic) nature of the regional metamorphism, and termination of the regional metamorphism prior to at least the later stages of thrusting, and possibly to all of the thrusting.

Stringham (1962) and Stringham and others (1961) concurred with the two-fold division of Precambrian rocks by Misch and Hazzard (1962), retained Anderson's (1931) name of Harrison Series for the older crystalline complex, and designated the overlying unconformable quartzites, schists,

and carbonates of the Raft River Range as the Dove Creek Formation. In the mapping of metamorphic rocks in the Grouse Creek Mountains and vicinity, however, Stringham and others (1961) erred in that much of what is shown as Harrison Series is actually Dove Creek Formation, intruded by either Tertiary adamellite or remobilized Archean adamellite gneiss, as recognized by Todd (1973). Stringham (1961) interpreted both the Harrison Series and Dove Creek Formation to be Middle Precambrian in age.

Geochronologic studies have contributed significantly to unraveling geologic complexities in the Raft River area. Results have substantiated the interpretations of some early workers while invalidating those of others. Notable are the studies by Sayyah (1965), Armstrong and Hills (1967), J.A. Whelan (quoted in Condie, 1966), and Robert Zartman (quoted in Todd, 1973, and in Compton, 1972, 1975),all of whom obtained Rb-Sr whole-rock isochron ages attesting to the great antiquity of the crystalline basement complex and proving it to be Archean or Precambrian W greater than 2.5 b.y. in age. These age dates thus substantiated the general Precambrian age interpretations of Misch (1960), Stringham (1961), and Misch and Hazzard (1962) and demonstrated that the crystalline basement complex forming the cores of the Raft River, Grouse Creek, and Albion Ranges were correlative, notwithstanding some minor differences in lithologies and intensity of deformation.

Armstrong and Hansen (1966) attempted to refine the age of regional metamorphism by K-Ar dating of metamorphic minerals and rocks in eastern Nevada, western and northwestern Utah and south-central Idaho. Their results, completely unexpected, indicated that all the metamorphic rocks cooled synchronously, presumably as a result of Tertiary uplift. They also pointed out that a discrepancy of nearly 100 million years exists

between the time of metamorphism inferred from geologic evidence and the measured Tertiary dates (Armstrong and Hansen, 1966). Rb-Sr whole-rock isochron ages of 2.5 b.y. and 30 m.y. obtained by Armstrong and Hills (1967) for the Green Creek Complex and the Almo pluton, respectively, proved conclusively that the basement complex was of Archean (Precambrian W) age, that both Archean and Tertiary age intrusives were present, and that the Cassia Batholith and the Albion Range Group of Anderson (1931, 1934) were both composite units. On the basis of regional stratigraphy and geochronologic data, Armstrong and Hills (1967) concluded that the time span of regional metamorphism and deformation in the Albion Range was post-Triassic to pre-Late Cretaceous, although metamorphic temperatures, diffusion, recrystallization, and isotopic exchange probably continued from late Cretaceous through Oligocene time.

Only in the last 20 years have the results of detailed field studies of structure, stratigraphy, and metamorphism become available, the major contributions being those of Armstrong (1968a, 1970), Compton (1972, 1975), Todd (1973), Compton and Todd (1977), Compton and others (1977), and Miller (1977, 1978). Armstrong (1968a), building on the pioneering work of Anderson (1931, 1934), detailed the results of approximately eight years of work in the Albion Range. He described stratigraphic sections and the general geology, proposed formal stratigraphic nomenclature and correlations, recognized the mantled gneiss domes of the Albion Range, and advanced a Paleozoic age for Stringham's (1961) Dove Creek Group (Armstrong, 1968a). He also observed that metamorphic grade generally increased stratigraphically downward and westward in the area, and recognized that deformation resulting from mid-Mesozoic regional metamorphism had produced two penetrative fabrics (Armstrong, 1968a). After a field trip to the area with other geologists, Armstrong (1970) acknowledged that his

structural and stratigraphic interpretations in the Albion Range were oversimplified and that new field observations invalidated certain structural interpretations, stratigraphic correlations, and age assignments in the Albion Range.

Compton (1972, 1975) mapped the Park Valley and Yost quadrangles for the U.S.G.S., clarified structural and stratigraphic relations, and provided the first detailed geologic maps of these two areas. These two maps cover most of the Raft River and central Grouse Creek Mountains. Todd (1973), a graduate student of Compton, conducted a detailed structural and petrographic study of the adamellite gneiss at the core of the central Grouse Creek Mountains. She determined the gneiss to be an igneous intrusion and part of the areally extensive Archean basement complex which had been intruded by a Tertiary pluton 25 m.y. Within the upper 150 feet, the gneiss was remobilized by metasomatism related to the Tertiary pluton and by tectonic forces, and both autochthonous and allochthonous rocks were subjected to two phases of ductile deformation.

Compton and others (1977) contributed significantly to an understanding of the geology of the Raft River area. They documented multiple metamorphic deformations and directions of thrusting, juxtaposition of constrasting metamorphic grades in allochthonous and autochthonous rocks, and noted systematic increases in metamorphic grade downward and westward in the autochthon. Field observations and radiometric data also indicated some metamorphism and low-angle faulting were still underway as recently as 25 m.y. ago, and cooling of some parts of the area below 400°C occurred as recently as 10 m.y. ago (Compton and others, 1977).

Miller (1977, 1978) studied the deformation of Big Bertha dome, the northernmost dome in a chain of five in the Albion Range. He described four phases of ductile deformation and interpreted the major deformation and metamorphism to have occured sometime between Late Triassic and Middle Cretaceous time, with less intense deformation continuing in the more deeply buried rocks until Oligocene or Miocene time.

A number of other publications that present information or ideas pertinent to the Raft River area are mentioned only briefly here. These include the geochronologic summaries by Armstrong (1975, 1976), the regional stratigraphic and structural syntheses of Precambrian rocks by Eardley and Hatch (1940) and Condie (1966, 1969), the discussion of metamorphic core complexes by Davis and Coney (1979), the compilation on Precambrian rocks of North America by King (1976), the discussion of lithologies, age dates, and contact relations of the Facer Creek Formation by Crittenden and others (1971) and Sorensen and Crittenden (1976), the discussion of water resources of the Raft River Basin by Nace and others (1961), and the discussion and reply of Compton and others' (1977) work by Crittenden (1979) and Compton and Todd (1979), respectively. Notwithstanding the significant contributions of all of the previously mentioned investigators, some structural, stratigraphic, and geochronologic problems remain to be resolved, both locally and regionally, relative to Precambrian rocks.

Insofar as the primary objectives of the present study are concerned, the publications of Jones (1978a, 1978b), Karlstrom and Houston (1979), and Houston and Karlstrom (1980) serve as the basis for evaluating the uranium potential of the metasedimentary rocks in the Raft River area. Whereas many other publications deal with various aspects of uranium-bearing quartz-pebble conglomerates of early Proterozoic age, the report

by Houston and Karlstrom (1980) is the most recent and thorough in its treatment of the subject. It has been relied upon heavily in the present study. Except for the one-day field visit by BFEC and U.S.G.S. geologists and the recent study by Gallant (in press) in the Pocatello quadrangle, of which the Albion Range is a part, the Raft River area has never been studied from the perspective that its Precambrian rocks might host Proterozoic quartz-pebble conglomerate and/or Proterozoic unconformity-type uranium deposits. Evaluation of these possibilities has been the primary objective of this field reconnaissance and geochemical study.

Acknowledgements

While primary responsibility for supervision of the sampling, interpretation of the data, formulation of the conclusions, and preparation of this report necessarily rest with the principal investigator, the study could not have been completed without the cooperation and hard work of other personnel, namely, Fred Zoerner, Dave Filar, Peggie Gallagher, Linda Withrow, Don Merrick, Steven Rumba, Brad Taylor, and Pierre LaCombe. Special recognition is due Loyal Olson who served as field party chief and assisted the author in preparation of the various maps, figures, and tables in this report. Appreciation is also extended to various Bureau of Land Management and Sawtooth National Forest personnel in Burley, Idaho who participated in discussions of logistics and provided various maps.

We are also very grateful to the many private land owners in the study area, all too numerous to mention here, who permitted access to their lands and thereby facilitated sampling and observations. Stan Floyd

and Neil Twitchell with the Mountain View Mining Company also permitted access and sampling of their mine property. The author also benefited considerably from numerous conversations with geologists who have worked in the Raft River and Wasatch Mountains areas. Most notable are Max Crittenden, Dave Miller, Dr. Robert R. Compton, Dr. Richard L. Armstrong, Bruce Bryant, Harry Covington, Scott Keys, Ron Bruhn, and Dr. Helmut Doelling. Crittenden, Miller, and Keys kindly provided copies of publications and maps of their work, and Doelling allowed use of his unpublished geologic map, now in press, of Box Elder County, Utah. Bill Gallant also discussed preliminary results of his study of the uranium potential of the Pocatello quadrangle.

The others mentioned shared freely their experience and knowledge. The author also acknowledges the frequent encouragement and input of Harry Suekawa of Meiiji Resource Consultants, Rex Cole (formerly with WCS, BFEC), Saleh Abou-Zied, current project coordinator for WCS-BFEC, and Ron Helgerson, data processing coordinator for Oak Ridge Laboratory. Finally, thanks is extended to the editing staff of MRC and BFEC, both of whom have contributed to improvement of this report.

GEOLOGY

Introduction

The geology of the Raft River area is exceedingly complex. Only in the last 15 years has an effort been made to resolve numerous stratigraphic, structural, and metamorphic problems resulting from multiple episodes of folding, low-angle faulting, metamorphism, plutonism, and high-angle faulting. Whereas a much better understanding of the geology of the Raft River area now exists, many details are still lacking. Present knowledge, for the most part, largely reflects the pioneering efforts of R.L. Armstrong, R.R. Compton, and their students. A synthesis of their work, supplemented with observations made during the course of geochemical sampling and measuring stratigraphic sections in the area, forms the basis of the following discussion. Unresolved problems, points of conflict, and discussions of deformation models or of relations between the Cordilleran fold and thrust belt (Sevier orogenic belt of Armstrong, 1968b) and Cordilleran metamoprhic belt will not be addressed. For the reader interested in these problems or more details, the original publications should be consulted. The discussion that follows is intended only to familiarize the reader with the geology of the study area and to provide a framework within which to relate the results of the geochemical sampling and field observations.

Regional Geologic Setting

The Raft River area is part of an extensive belt of metamorphic rocks extending from Canada to Mexico (see fig. 3). This belt was designated

the Cordilleran metamorphic belt by Drewes (1978). It underlies the "hinterland" of the Sevier orogenic belt as defined by Roberts and Crittenden (1973). From the standpoint of Precambrian geology, the study area is also noteworthy because it comprises the westernmost exposures of the Wyoming Precambrian Province (fig. 4), an extensive area of igneous, metasedimentary, and metavolcanic rocks dating generally more than 2.5 b.y. (Armstrong and Hills, 1967; Condie, 1969; King, 1976; Crittenden, 1976).

Based on preferred age interpretations, distinctive lithologies, and stratigraphic and structural associations, rocks in the study area can be conveniently subdivided into three major groupings (table I). They are, in ascending stratigraphic order: (1) an Archean crystalline basement complex, (2) an unconformably overlying and much deformed metasedimentary and sedimentary succession of Precambrian and Paleozoic rocks, and (3) Cenozoic sedimentary,volcanic, and plutonic rocks. The following discussion emphasizes the Archean and Precambrian X (?) rocks which were pre-selected for study because of their potential to host Proterozoic quartz-pebble conglomerate and unconformity-type uranium deposits. Considerably fewer details are presented on the Precambrian Z (?), Paleozoic, and Cenozoic rocks which obviously lack much potential and, therefore, fall outside the scope of this study.

Archean Crystalline Basement Complex

The geologic history of the Raft River area begins with the crystalline basement complexes in the cores of the Raft River, Grouse Creek, and Albion Ranges (plate 1). These complexes consist of fine-to coarse-grained terrigenous clastics and silicic to mafic volcanic and plutonic rocks,

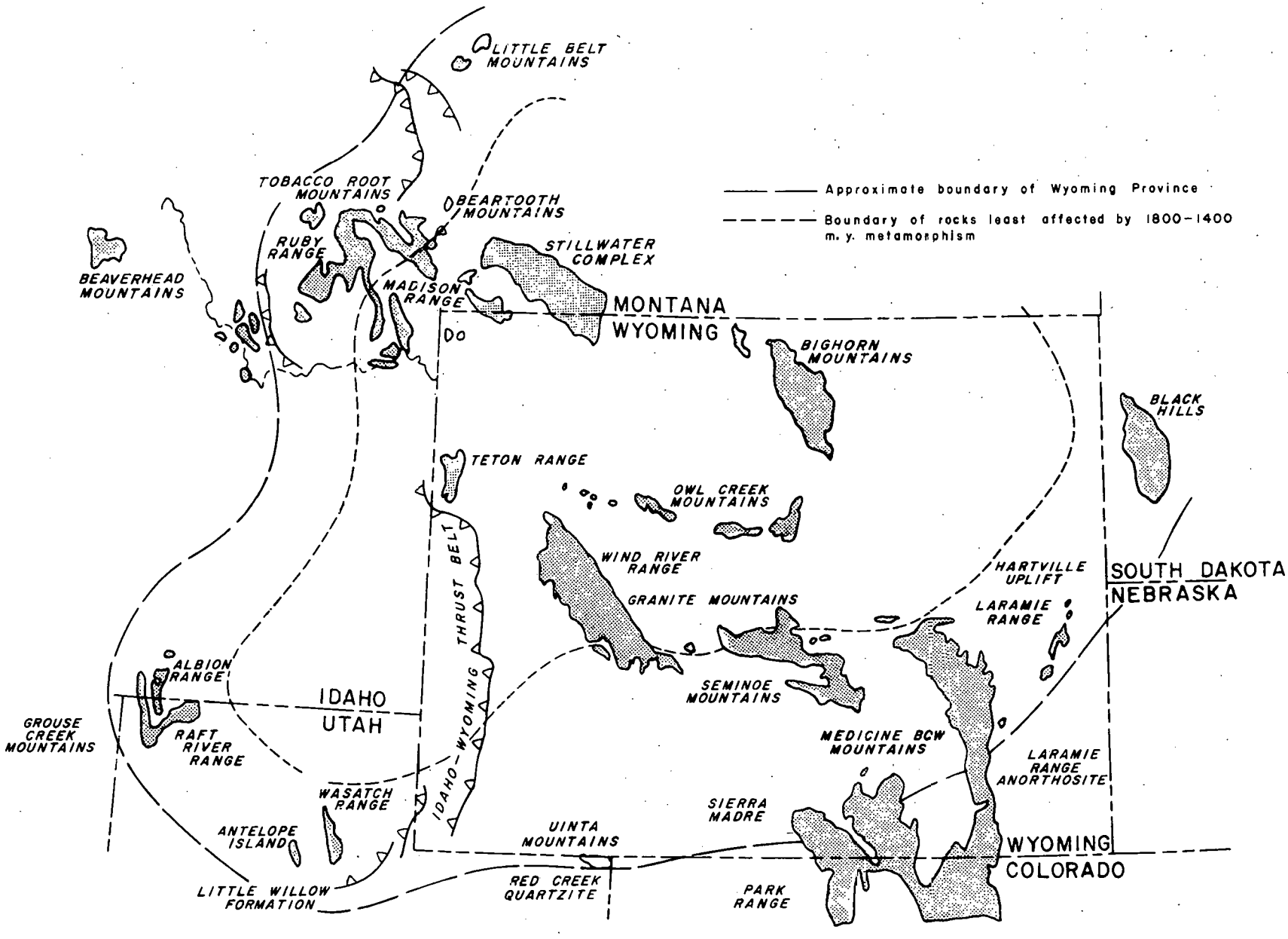


Figure 4. Wyoming Precambrian Province
(Modified after Karlstrom, 1979)

now metamorphosed to greenschist or amphibolite grade. Armstrong (1968a) has proposed the formal name, Green Creek Complex, for these rocks after exposures in Green Creek on the north side of Cache Peak in the Albion Range. Excellent exposures also occur in the many deeply dissected canyons in the eastern half of the Raft River Mountains and in the central Grouse Creek Range. As evidenced by relict sedimentary structures and contact relations in the Raft River Range, the oldest exposed rocks within the basement complexes are shales, siltstones, argillaceous and feldspathic sandstones, and pebbly to cobbly mudstones which have been metamorphosed to schists (Compton, 1975). The best outcrops of these rocks are in Rice and Jim Canyons in the northeast part of the Raft River Range.

Contact relations suggest amphibolites are the next younger rocks in the study area. Field observations indicate that they are widespread in the eastern part of the Raft River Range (Compton, 1975) and in the area of Green Creek in the Albion Range (Armstrong, 1968a). According to Todd (1973), amphibolites comprise less than five percent of the basement complex in the Grouse Creek Mountains. They have been interpreted as metamorphosed dikes, sills, flows, and tuffs of mafic composition by Compton (1975) and Armstrong (1968a). Some of these bodies are tabular and comformable with bedding in the older schists and quartzites. Others exhibit schistose exteriors and granular interiors, suggesting lava flows or small intrusives (Compton, 1975).

Metamorphosed trondhjemite and pegmatite form roughly conformable sheets and irregular bodies in the older schists and amphibolites in the Raft River Range (Compton, 1975) and occur as infolded and interlayered bodies in the younger adamellite gneiss in the Grouse Creek Mountains (Todd, 1973). The best exposures occur in Jim, Rice, Italian, Rosavere Fork, and Clear Creek Canyons in the northeast part of the Raft River Mountains.

Compton (1975) observed younger adamellite dikes intruding the trondhjemite and pegmatite in upper Rosavere Fork.

Field observations of contact relations throughout the study area indicate the youngest and most widespread rock of the Green Creek Complex is a variably metamorphosed adamellite which either intrudes or engulfs all of the previously described lithologies (Armstrong, 1968a; Todd, 1973; Compton, 1972, 1975; Compton and others, 1977). At a few localities in the Grouse Creek Mountains, the adamellite gneiss has been remobilized by metasomatic and tectonic processes and intrudes the unconformably overlying metasedimentary rocks (Todd, 1973).

Sayyah (1965), Armstrong and Hills (1967), J.A. Whelan (quoted in Condie, 1966), Robert Zartman (quoted in Todd, 1973 and in Compton, 1972, 1975), Compton and others (1977), and Harry R. Covington (oral communication, 5/9/80) obtained Rb-Sr whole-rock isochron ages on samples of gneiss and schist collected from various localities in the crystalline basement complexes. The resulting age dates range from 2.2 to 3.7 b.y. Inasmuch as these rocks have probably all behaved to some degree as open systems (Armstrong and Hills, 1967; Compton and others, 1977), the younger age dates probably reflect chemical alteration of the original rocks or perhaps the effects of a younger thermal event (Damon and others, 1966). In either case, these age data are probably minimum ages and provide conclusive proof of an Archean or Precambrian W age for the Green Creek Complex and confirm the basement complexes coring the Raft River, Grouse Creek, and Albion Ranges are correlative, notwithstanding some differences in proportions of the various lithologies and in intensities of deformation and metamorphism. The age data also substantiate the preferred interpretations of Anderson (1931), Stokes (1952), Felix (1956), Misch (1960), Stringham (1961),

and Misch and Hazzard (1962), all of whom interpreted some or all of the rocks in the crystalline basement complexes as Precambrian in age.

On a regional basis the crystalline basement complex of the Raft River area would correlate with the Farmington Canyon Complex in the Wasatch Range (Max Crittenden, oral communication, 10/5/79), and possibly with the North Ruby-East Humboldt Complex in eastern Nevada. King (1878) and Hague and Emmons (1877) assigned the latter to the Archean, and this was also the preferred interpretation of Misch (1960) and Misch and Hazzard (1962) whose regional studies led them to assign a tentative early Precambrian age to the complexes.

Field observations by Armstrong (1968a), Todd (1973), Compton and others (1977), and the writer confirm that the greatest deformation of the Green Creek Complex is restricted to the upper few hundred meters, with intensity increasing upward toward the unconformity and overlying metasedimentary succession. Metamoprhic grade varies systematically in the crystalline basement complex, ranging from dominantly greenshist in the east to amphibolite in the west (Armstrong, 1968a; Todd, 1973; and Compton and others, 1977; Miller, 1978). While the major metamorphic deformation occurred sometime during late Triassic to Oligocene time, an episode of penetrative deformation and regional metamorphism to amphibolite facies is also recorded in the Green Creek Complex and must have accompained and/or followed emplacement of the adamellite (Armstrong, 1968a). Evidence of this metamorphic event is recorded by the relict east-west foliation in the Green Creek Complex and by the change in character of the deformation in rocks below the Conner Creek Formation, as recognized in the Albion Range by Armstrong (1968a). Recognition of this event elsewhere in the study area is apparently obscured by younger superimposed fabrics formed

during regional metamoprhism.

Profound Regional Unconformity

Sometime following emplacement of the adamellite and regional metamorphism of the Archean rocks, significant uplift and subsequent erosion took place, resulting in the formation of a profound regional unconformity upon which the overlying metasedimentary succession was deposited (table I). The contact between the Archean rocks and the overlying metasedimentary succession is an unconformity, as is indicated by the following: (1) discordant contact relations wherein Elba Quartzite truncates and rests upon various lithologies of the underlying Green Creek Complex; (2) rare clasts of adamellite comprising pebbles or cobbles in the common, but not ubiquitous, basal Elba conglomerate (Ron Bruhn, oral communication, 11/30/79); (3) variations in relief along the contact as it is traced laterally in the area of Green Creek in the Albion Range and in Clear Creek Canyon in the Raft River Range; (4) regional persistence of distinctive Elba Quartzite above the basement complex; (5) the local occurrence of white mica-rich schist between the Elba quartzite or cobble conglomerate and underlying adamellite, which is interpreted to be a paleoregolith; (6) the lack of extensive brecciation and cataclasis coincident with the contact; and (7) by consensus of all who have conducted detailed studies in the Raft River area (Stokes, 1952; Misch, 1960; Misch and Hazzard, 1962; Stringham, 1961; Condie, 1966; Armstrong and Hills, 1967; Armstrong, 1968a; Compton, 1972, Todd, 1973; Compton and others, 1977).

Tens of feet of relief on the unconformity are evident, particularly in the area north of Cache Peak in the Albion Range and along the north side of Clear Creek Canyon in the northeastern part of the Raft River Range. Locally, depressions in the surface are filled with a variable thickness of cobble conglomerate in which the clasts are highly deformed into prolate ellipsoids. The cobbles consist predominantly of quartzite, but rare clasts of adamellite and black chert have been noted by Ron Bruhn (oral communication, 11/30/79). Deformation occurred during the second metamorphic deformation (D2).

The basal conglomerate is not ubiquitous. At some places in Clear Creek Canyon, a white mica-rich schist is present between the basal quartzite or conglomerate and the underlying adamellite. Armstrong (1968a) and Compton (1975) both interpreted this schist to be a metamorphosed paleo-regolith.

Precambrian (?) and Paleozoic Rocks

Unconformity overlying the Green Creek Complex is a sequence of Precambrian X (?) and Z (?) and Paleozoic rocks ranging in thickness from 1219 meters (4000 feet; Todd, 1973) to more than 12,192 meters (40,000 feet; Compton and others, 1977). For simplicity of discussion, these rocks are here treated collectively as a unit because they have been intensely deformed during multiple phases of low-angle faulting and ductile deformation, resulting in penetrative fabrics and regional metamorphism to greenschist or amphibolite grade. Superimposed on these regional deformations are the effects of contact metamorphism by Tertiary intrusives in the Grouse Creek

Mountains (Todd, 1973) and high-angle faulting throughout the area. Notwithstanding the severity and number of deformations, the stratigraphic units generally remain in their correct stratigraphic order throughout most of the Raft River area (Armstrong, 1968a; Todd, 1973; Compton, 1972, 1975). Deviations from the normal and complex field relations, however, exist locally, particularly on the scale of an outcrop.

Stratigraphic sections representing the work of each of the major investigators were compiled and are presented in table I. Stratigraphic terminology for each area is a combination of the formal and informal names of Armstrong (1968a) and Compton (1972, 1975). Examination of table I reveals significant differences in stratigraphy, age assignments, and amount of structural complexity in each of the five areas listed. Also noteworthy is the conspicuous absence of the thick Precambrian Z (?) units of Miller (1978) in the Raft River, Dove Creek, and Grouse Creek Mountains, although rocks of this age are known from nearby areas of the Great Basin (Eardley and Hatch, 1940; Misch and Hazzard, 1962; Woodward, 1967; Crittenden and others, 1971b). For more details and a discussion of this stratigraphic anomaly, the interested reader is referred to Crittenden and others (1971a), Miller (1978), Crittenden (1979) and Compton and Todd (1979).

On the basis of the preferred age interpretations shown in table I, the Precambrian-Paleozoic stratigraphic sections can be subdivided into three subgroups, namely (1) the Elba Quartzite through Schist of Stevens Spring, (2) the Daley Creek Quartzite through Robinson Creek assemblage, and (3) the Quartzite of Clarks Basin and younger Paleozoic and Triassic

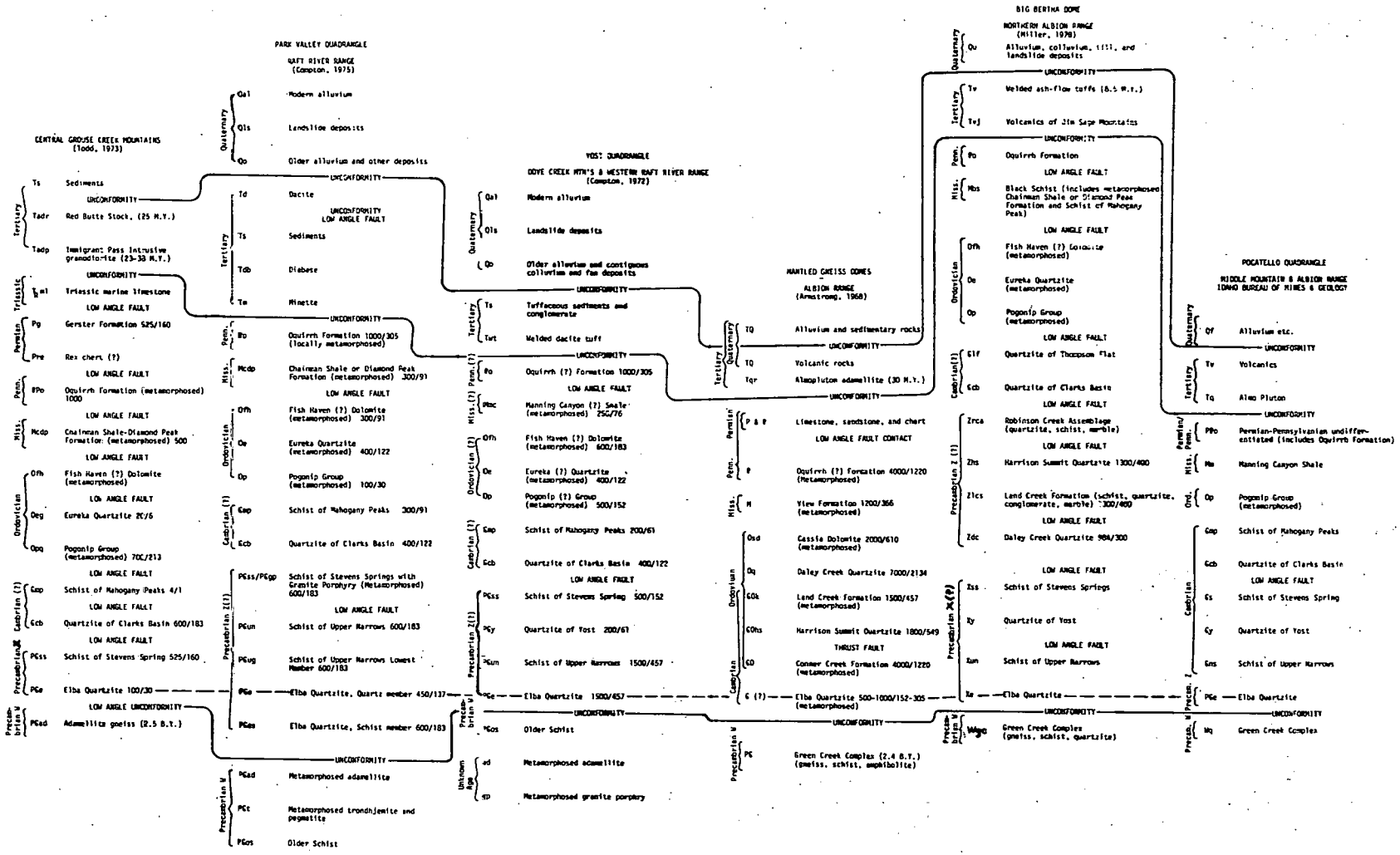


Table I. Stratigraphic Columns For Various Localities in The Raft River Area.

rocks. The middle and upper, or younger, subgroups will be discussed only briefly in the succeeding paragraphs of this section because they have no potential to host Proterozoic quartz-pebble conglomerate or Proterozoic unconformity-type uranium deposits. The lower or older subgroup will be discussed in more detail, because it is the Elba and Yost Quartzites which were pre-selected for evaluation of their potential to host Proterozoic quartz-pebble conglomerate uranium deposits. These two quartzite units will be described in considerable detail in a subsequent section of this report.

Lower Subgroup-Precambrian X (?) Rocks

The lower and older subgroup, consisting of the Elba Quartzite, Schist of Upper Narrows, Yost Quartzite, and Schist of Stevens Spring, forms an apparently conformable sequence of genetically related quartzites and schists which are widely distributed in the Raft River area (table I). As previously mentioned, the basal unit, the Elba Quartzite, rests unconformably on the underlying Green Creek Complex throughout the Raft River area. Thicknesses of the lower subgroup, or the individual units, vary considerably throughout the area (table I). Individual units and beds commonly exhibit attenuation, as evidenced by closely-spaced shear planes which truncate bedding at very low angles, well-developed foliation which parallels bedding and axial planes of folds, and large clasts and mineral grains which are highly deformed into prolate ellipsoids. Contacts between quartzite and schist units are generally covered, but where visible they commonly exhibit gradational relations over a few feet or tens of feet.

Locally, these contacts display appreciable crumpling and shearing, indicating slippage approximately parallel to bedding surfaces in quartzites and to foliation (D1) in schists.

Notwithstanding extensive regional as well as local deformations, some primary sedimentary structures are still clearly discernible in the quartzites. The most ubiquitous of these are the parallel bedding, cross-bedding which ranges in scale from a few centimeters (dominant) to three or more meters locally, very weak clast imbrication in pebble conglomerates, and well rounded but highly deformed pebbles and cobbles in quartzite conglomerates. The cross-laminae are accentuated by alternating quartz-rich and dark, heavy mineral-rich laminae. Accessory minerals include ilmenite, rutile, sphene, magnetite, zircon, tourmaline, garnet, epidote, apatite, and uranothorite (?) (Compton, 1972, 1975; Todd, 1973; Miller, 1978; Bill Gallant, oral communcation, 11/13/79). Pyrite is locally abundant but conspicuously associated with intense near-vertical fracturing of the Elba and Yost Quartzites in the Raft River and Dove Creek Mountains. The fracturing is quite late in the deformation sequence, as it truncates metamorphic folds, foliation, and low-angle shearing. The pyrite is, therefore, definitely epigenetic and probably related to a hydrothermal system of Oligocene or younger age.

Primary textures in the quartzites of the lower subgroup have, for the most part, been obliterated by deformation and recrystallization. The thinness of the parallel and cross-laminae, the uniformity of heavy mineral grain sizes (Compton, 1975), and the dominantly quartzose composition suggest that originally the sandstones were fine to medium-grained and generally well sorted. The quartzites are typically white or light gray, dense,

vitreous, and thinly to medium bedded. Tan, brown, red, green, and blue-green varieties were also observed. The green and blue-green types owe their color to chromium mica and are, therefore, fuchsitic quartzites. The green, blue-green, and white mica-rich quartzites of the Elba and Yost Formations possess a well-developed flaggy bedding. These quartzites are quarried at a number of localities throughout the study area and sold as a decorative building stone. Overall, the dominant lithology is a relatively pure quartzite. However, micaceous, feldspathic, and arkosic quartzites, and pebbly to cobbly quartzite conglomerates comprise signficant portions of the subfacies of the Elba and Yost Quartzites.

Schists of the lower subgroup are poorly exposed, generally comprising float-covered slopes between quartzite units. They therefore received less attention than the quartzite and conglomerate units. The dominant schist lithology is a quartz-muscovite schist, but biotitic and feldspathic variants also exist. The quartz-muscovite schists contain numerous, apparently tectonically separated, lenses of silvery, graphitic phyllite measuring one-half to two inches across and one-tenth of an inch thick (Compton, 1972, 1975; Todd, 1973). Within the schist of the Upper Narrows in the Raft River Range, Compton (1975) recognized and mapped separate fine-grained gneiss and cataclastic schist members. Collectively speaking, schists of the lower subgroup are known for their high mica, quartz, and feldspar contents, quartz and quartz-feldspar metamorphic segregations, and sparse but distinctive lithologies which are not known to occur in Precambrian Y, Precambrian Z, or Paleozoic formations elsewhere in the region (Compton, 1975; Compton and Todd, 1979; Crittenden, 1979;

Crittenden and others, 1971a, 1971b; Miller, 1978).

Distinctive but sparse lithologies of the lower subgroup include: (1) fuchsitic quartzites, hematitic schists, metabasaltic green schist, and metatuffs (?), all in the Elba Quartzite (Compton, 1975);(2) quartz, quartz-feldspar, potassic granite, and carbonate-bearing syenite lenses, interpreted to be metamoprhic segregations, and metadiabase, amphibole schists, and metatuffs (?) of silicic and mafic compositions, all in the Schist of the Upper Narrows (Compton, 1975; Miller 1978); fuchsitic quartzite, magnetite-rich quartzites, and hematitic schists in the Quartzite of Yost (Compton, 1972);and/or (4) quartz segregations, meta-rhyolite porphyry, hornblende schists, granite porphyry, metatuffs (?), and metadiabase in the Schist of Stevens Spring (Todd, 1973; Compton, 1973, 1975).

Unequivocal straigraphic correlations and radiometric age dates are entirely lacking for metasedimentary rocks of the lower subgroup. Thus, the age of the Elba-Upper Narrows-Yost-Stevens Spring sequence is unknown. The preferred age interpretations of the various investigations are shown in table I. Miller's (1978) interpretation is favored because it not only clarifies stratigraphic and structural relationships in the Raft River area but also preserves the integrity of regional Precambrian correlations throughout nearby areas of the Great Basin (Crittenden and others, 1971b; Crittenden, 1976, 1979). Within the Raft River area, the published literature and maps clearly reveal no problem in recognizing, correlating, and mapping individual units of the subgroup. However, lack of similar rocks in the nearby ranges precludes short distance correlation. Neighboring ranges consist of younger Paleozoic sequences which show

little evidence of the high-grade metamorphism and deformation that affect rocks in the Raft River area.

Miller's (1978) interpretation of a Precambrian X age for the lower subgroup is based upon correlation of the sequence with the lithologically similar Facer Creek Formation in the Wasatch Range of Utah, which was metamorphosed 1.4 to 1.7 b.y. ago (Crittenden and others, 1971a). Admittedly, the great distance (150-200 miles) over which the proposed correlation has to be made renders it suspect, but it is strengthened by two observations. First, rounded, fuchsitic quartzite clasts occur in conglomerate of the Muddy Canyon Formation near Huntsville, Utah, in tillites on Antelope Island, Utah and in the Dutch Peak tillite of the Sheeprock Mountains, Utah (Crittenden and others, 1971b). All of these localities are within 140 miles of the study area. The conglomerate and tillites are part of a thick, regionally extensive, and generally conformable sequence of well-dated and reliably-correlated Precambrian Z rocks (Crittenden and others, 1971b; Crittenden, 1976). Secondly, many geologists have described granite, granite gneiss, migmatite, schist, quartzite, and marble clasts, ranging in size from pebbles to boulders, that occur in the tillites and diamictites of Precambrian Z sequences at localities in southern Idaho, central Utah, and eastern Nevada (Eardley and Hatch, 1962; Crittenden and others, 1971b).

Consideration of these two observations, in conjunction with the metamorphic ages, 1.4 to 1.8 b.y., of both the Facer Creek Formation and the Farmington Canyon Complex, and the angular unconformity between the Facer Creek Formation and the overlying Precambrian Z sequence (Huntsville) lead to the following conclusions:

(1) A major episode of regional metamorphism and orogeny affected Archean crystalline basement complexes and overlying metasedimentary rocks of Precambrian X age throughout the Wastach Range, Antelope Island, and Carrington Island areas in Utah and presumably in adjacent areas now largely concealed by younger rocks and structures. This event was recognized by Eardley and Hatch (1940), Condie (1969), and Crittenden (1976);

(2) This deformed and uplifted terrain served as provenance for the younger Precambrian Z sequences in the eastern Great Basin, as evidenced by the distinctive igneous and metamorphic lithologies of clasts in the tillites, diamictites, and conglomerates;

(3) The Elba-Upper Narrows-Yost-Stevens Spring sequence is, therefore, interpreted to be Precambrian X in age because of the presence of fuchsitic quartzite clasts in well dated and reliably correlated Precambrian Z sequences in southern Idaho and northern and central Utah; the striking contrasts in lithology and metamorphic grade of thick, well exposed, terrigenous clastic sequences of presumed Precambrian Y age in the Wasatch Range; and the lithologic similarity of the lower subgroup to the Facer Creek Formation which was metamorphosed 1.4 to 1.7 b.y. ago, occurs unconformably below Precambrian Z rocks in the upper plate of the Willard thrust, and comprises part of an allochthonous

geosynclinal sequence which was thrust eastward over shelf facies during the Sevier orogeny (Crittenden and others, 1971a; Crittenden, 1976).

Published descriptions of the Precambrian Y and Z rocks of the eastern Great Basin lack the distinctive lithologies of the older metasedimentary rocks of the Raft River area. Thus, the age of the lower subgroup appears bracketed between the unconformably underlying Green Creek Complex (2.5 b.y.) and well dated and reliably correlated Precambrian Z sequences, containing distinctive fuchsitic quartzite and other igneous and metamorphic clasts (800 m.y.). Because of the striking lithologic contrasts between the older subgroup and known Precambrian Y Formations, the proposed correlation and corresponding age of Miller (1978) and Crittenden and others (1971a) is preferred.

The Green Creek Complex and some of the older metasedimentary rocks of the lower subgroup, namely the Elba Quartzite and the Schist of the Upper Narrows, comprise the autochthon in the Raft River area (table I). Although the Yost Quartzite and Schist of Stevens Spring are interpreted to be genetic parts of the lower subgroup, they have, nonetheless, participated to a much greater extent in the low-angle faulting and regional deformation. While it is acknowledged that they have

been displaced some unknown distance from their original site of accumulation, they probably are not far removed and certainly have not been displaced as far as overlying rocks of the middle and upper subgroups. Thus, the Yost Quartzite and Schist of Stevens Spring are not viewed strictly as parts of the allochthon. Extensive low-angle faulting and ductile deformation also suggest rocks of the lower subgroup were much thicker and perhaps even more diverse lithologically than is indicated by the preserved units. Original stratigraphic and structural relationships between rocks of the lower subgroup and those of overlying middle and upper subgroups are not known. Contact relations have been obscured by extensive low-angle faulting, metamorphism, and erosion.

Middle Subgroup - Precambrian Z (?) Rocks

The middle subgroup, consisting of the Daley Creek-Land Creek-Harrison Summit-Robinson Creek Assemblage, is present only in the northern part of the Albion Range (Armstrong, 1968a; Miller, 1978). Armstrong (1968a) mapped and named the Daley Creek, Land Creek and Harrison Summit Formations of the middle subgroup (table I), but he failed to recognize

the entire sequence was overturned, as evidenced by well developed cross-bedding (Armstrong, 1970). His stratigraphic order and age assignments are therefore just the reverse of Miller's (1978) and those described in this report (table I).

The Robinson Creek assemblage, mapped and informally named by Miller (1978) for the uppermost and youngest unit of the middle subgroup, is upright according to cross-bedding, but tectonically overlies the lower three units. On a regional basis, stratigraphic and age relations of the middle subgroup are uncertain. Within the subgroup, however, the various units are conformable and exhibit gradational contacts, except for the Robinson Creek assemblage. The following discussion draws heavily on the work of Armstrong (1968a, 1970) and Miller (1978), as these units were not studied in detail or sampled extensively during the study.

The Daley Creek Quartzite is the lowermost and oldest unit of the middle subgroup. It was named by Armstrong (1968a) for a massive, thick, uniform quartzite which crops out on a high ridge north of Mount Harrison in the area of Daley Creek. The dominant lithology is gray or tan, medium to thick bedded, locally micaceous, and/or feldspathic quartzite (Armstrong, 1968a). Grit and quartzite pebble conglomerates are scattered throughout the formation, and a few thin beds of staurolite-garnet-bearing, biotite-muscovite-quartz schist and blue-gray limestone occur in the upper part (Armstrong, 1968a; Miller, 1978). Ripple marks and cross-bedding are well preserved, as noted by Miller (1978).

The Land Creek Formation conformably overlies the Daley Creek Quartzite (Miller, 1978). The type locality is Land Creek, located a few

miles northwest of Mount Harrison (Armstrong, 1968a). Miller (1978) recognized and described five separate members, three schists and two quartzites. Lithologies of the Land Creek Formation are more diverse and contrast noticeably with those of the overlying and underlying quartzite units. They include staurolite and/or garnet-bearing schists with muscovite and/or biotite, calcareous schists, and pelitic schists (Miller, 1978). Schist typically weathers to shades of brown, whereas quartzites are mostly light gray or white. The quartzites are medium to coarse-grained and locally contain interbedded pebble to boulder conglomerate with clasts of quartzite, schist, felsic intrusive rock, and large feldspar crystals (Miller, 1978).

Armstrong (1968a) named the Harrison Summit Quartzite after exposures of a prominent, thick, massive quartzite that crops out on Mount Harrison in the Albion Range. The quartzites are generally light brown, cream, or gray, medium to thick-bedded, and fine to coarse-grained with some muscovite on parting surfaces, and occasional feldspathic conglomerate beds (Miller, 1978). Cross-bedding ranges from small to large scale and is well displayed in outcrops above Cleveland Lake and below the watch tower on Mount Harrison. The Harrison Summit Quartzite, when viewed from a distance, can be easily mistaken for the Elba Quartzite because of its ledgy character and two-fold division of color, tan to brown above and gray to white below.

The Robinson Creek assemblage was named by Miller (1978) for an upright, interbedded sequence of quartzite, schist, and marble which overlies the overturned Daley Creek-Land Creek-Harrison Summit sequence.

Low-angle faulting and folding obscure relationships and preclude definitive correlations, but on the basis of gross lithologic similarity and structural relations, Miller (1978) believed the assemblage might be correlative with part of the underlying units. Lithologies include dark gray calcite marble; gray, micaceous marble; tan, quartzose schist; and gray, thin to thick-bedded, locally cross-bedded quartzite (Miller, 1978).

As mentioned previously, rocks of the middle subgroup occur only in the northern part of the Albion Range (table I). Moreover, similar rocks are not exposed in any of the ranges bordering the Raft River area. Stratigraphic relations, correlations, and ages of these middle subgroup rocks are therefore uncertain. Like Miller (1978), the writer reviewed published descriptions of Precambrian and Lower Cambrian sequences in the eastern Great Basin but was unable to improve upon his proposed correlation and age interpretation. Metamorphism and deformation of these rocks in the Albion Range and distances to exposures of possible correlatives elsewhere in the region preclude definitive statements.

The problem of correlation and age of the older metasedimentary rocks in the Raft River area is part of a stratigraphic anomaly first recognized by Crittenden and others (1971a) and subsequently discussed in greater detail by Miller (1978), Compton and Todd (1979), and Crittenden (1979). The proposed correlation and age interpretation of Miller (1978) are favored and adopted in this report. By this interpretation, rocks of the middle subgroup were derived from deformed, uplifted, and eroded exposures of the Green Creek Complex and the overlying lower subgroup (Elba through Schist of Stevens Spring) or their regional

correlatives, sometime following the 1.4 to 1.8 b.y. metamorphic and orogenic episode previously mentioned. The Daley Creek-Land Creek-Harrison Summit-Robinson Creek sequence is, therefore, interpreted to be correlative with some part of the regionally extensive Precambrian Z sequences in the eastern Great Basin. For more details concerning the problems of correlation and age of the older metasedimentary rocks in the eastern Great Basin, the reader is referred to the publications of Misch and Hazzard (1962), Armstrong (1968a), Crittenden and others (1971a, 1971b), Compton (1972, 1975), Compton and others (1977), Miller (1978), Compton and Todd (1979), and Crittenden (1979).

Sedimentary structures (parallel stratification, cross-bedding, and ripple marks), gradational contact relations, and interbedding of quartzite, schist, and marble suggest, in the absence of diagnostic fluvial indicators, that rocks of the middle subgroup were deposited in shallow, low to high energy, nearshore to offshore, marine environments. Heavy minerals, identified by hand lens, consist mainly of black opaque oxides. No detrital pyrite was observed in the quartzites or conglomerates. Collectively, these observations suggest that the coarse clastics were deposited under oxidizing conditions. Moreover, original thicknesses were undoubtedly somewhat greater than those indicated in table I because of thinning by low-angle faults and ductile flow. The tectonic setting during deposition was probably a deeply subsiding basin or, if the proposed correlation is correct, in the Cordilleran miogeosyncline. Consideration of the recognition-favorability criteria of Jones (1978a, 1978b) and Houston and Karlstrom (1980) leads to the conclusion that the middle

subgroup has no potential for Proterozoic quartz-pebble conglomerate or unconformity-type uranium deposits.

Upper Subgroup - Paleozoic and Mesozoic Rocks

The upper subgroup includes all of the metasedimentary and sedimentary rocks of presumed Paleozoic through Triassic age in the Raft River area (table I). Except for the quartzites of Clarks Basin and Thompson Flat, which are of uncertain but likely pre-Ordovician age, most of the formations of the upper subgroup are correlatives of easily recognized, well dated, and regionally extensive Paleozoic and Triassic formations in the eastern Great Basin. Within the study area, however, they are more highly deformed and metamorphosed than in other areas. Notwithstanding the deformation, metamorphism, and extensive low-angle faulting of the upper subgroup rocks, original stratigraphic order is maintained throughout the area. Exceptions are uncommon and caused by recumbent folding or imbricate faulting (Compton and others, 1977; Miller, 1978). The upper subgroup rocks, like those in the lower and middle subgroups, exhibit significant attenuation as evidenced by extensive low-angle faulting, ductile deformation, and greatly abbreviated stratigraphic section (Todd, 1973; Miller, 1978). Consideration of the stratigraphy in table I suggests the usual thick Silurian, Devonian, and Mississippian section of the eastern Great Basin is absent, but later work by Compton and others (1977) resulted in recognition of thin remnants in the Raft River area. They are, therefore, not absent due to an unconformity but rather are generally missing because of tectonic elimination. Thus, it appears that the conformable late Precambrian-Paleozoic-Triassic succession generally recognized throughout the eastern Great Basin is also present although highly attenuated,

deformed, and metamorphosed.

Prior to metamorphism the predominant lithology of the Paleozoic-Triassic sucession was marine limestone and dolomite, but regionally extensive quartz sandstone and black shale prevail at certain stratigraphic levels. Pennsylvanian and older rocks are now metamorphosed to marble, quartzite, and schist of various metamorphic grades. Initial deposition was in dominantly low to high energy, nearshore and offshore marine environments in the Cordilleran miogeosyncline.

Consideration of the recognition-favorability criteria of Jones (1978a, 1978b) and of Houston and Karlstrom (1980) leads to the conclusion that rocks of the upper subgroup have no potential to host Proterozoic quartz-pebble conglomerate or unconformity-type uranium deposits. Collectively speaking, the Paleozoic and Mesozoic rocks are the least radioactive or uraniferous rocks in the study area.

CENOZOIC ROCKS

Based on the mapping and reports of Piper (1923), Anderson (1931), Nace and others (1961), Armstrong (1968a), Compton (1972, 1975), Compton and others (1977), and Keys and Sullivan (1979), rocks of Tertiary and Quaternary age are widely distributed in the Raft River area (table I). They can be conveniently subdivided into five groups, listed in order of decreasing age: (1) granitic intrusives of Tertiary age (40 to 25 m.y.) in the Grouse Creek and Albion Ranges; (2) thick, tuffaceous, fluvial-lacustrine, basin-fill sediments of late Miocene and Pliocene age, including underlying, intercalated and overlying dominantly silicic

volcanic flow rocks; (3) thin, fluvial-lacustrine, basin-fill sediments of Pleistocene age; (4) thin alluvium and colluvium of Pleistocene to Recent age, occupying the major drainages of the mountain ranges and forming terraces on older basin-fill sequences; and (5) thin, alluvium of Recent age filling drainages incised into the older alluvium and basin-fill sediments. None of these rocks and sediments will be discussed in any detail because they form limited exposures within and around the perimeter of the Raft River, Dove Creek, Grouse Creek, and Albion Mountains and were observed, for the most part, only incidentally during stream sediment sampling. Moreover, evaluation of their uranium potential was not an objective of this study, and time and budget constraints precluded extensive study or sampling. Excellent descriptions and more details are contained in the references previously cited.

Granitic Intrusives

The granitic intrusives of the Grouse Creek and Albion Ranges have been studied, mapped, described, and dated by Baker (1959), Armstrong and Hills (1967), Armstrong (1968a), Todd (1973), and Compton and others (1977). They are, from south to north, the Immigrant Pass intrusion, Red Butte stock, Vipont Mountain intrusion, Middle Mountain injection complex, Almo pluton, and an unnamed biotite granodiorite pluton exposed west of Cache Peak. All are adamellite or granitic rocks approaching adamellite. All of the intrusives occur in the westernmost, highest metamorphic grade rocks of the autochthon (Miller, 1978). Rb-Sr whole-rock isochron ages are 38 m.y. for the Immigrant Pass intrusion (Compton and others, 1977), 30 m.y. for the Almo pluton (Armstrong and Hills, 1967), and 25 m.y. for Red Butte stock (Todd, 1973). The Vipont Mountain intrusion, the Middle Mountain injection complex, and the unnamed pluton west of Cache Peak are synkinematic, as evidenced by foliated and lineated fabrics with trends parallel to the second set of metamorphic fabrics in the intruded country rocks (table II). Red Butte stock is late synkinematic to dominantly postkinematic

1972, 1975). Age dates of 8.5 to 9 m.y. have been obtained on volcanic rocks along the west side of the Albion Range (Armstrong, 1976), but otherwise, the age and correlation of volcanic rocks in the study area remain undefined. Based on the Pliocene age dates of Armstrong (1976) and the reported stratigraphic relations between volcanic rocks and the tuffaceous, fluvial-lacustrine, basin-fill sediments of late Miocene and Pliocene age, it appears that volcanism was more or less continuous throughout Miocene and Pliocene times.

It is noteworthy that during exploration drilling of the nearby Raft River geothermal area, no significant thickness of Tertiary volcanic rocks was penetrated, according to Harry Covington of the U.S.G.S. (oral communication, 5/9/80; Keys and Sullivan, 1979). Holes were collared in alluvium, penetrated the Raft River and Salt Lake Formations and a very thin section of Precambrian (?) quartzite and schist, and bottomed in adamellite of Precambrian W age (2.3 b.y.) at a depth of 6,000 feet or less (H. Covington, oral communication, 5/9/80; Keys and Sullivan, 1979).

The best exposures of older basin-fill sediments are located both east and west of Stanrod, in the area of Yost, and to a lesser extent, along Junction and Grouse Creeks. Susceptibility to erosion and a thin veneer of overlying alluvium result in generally scattered, poor exposures. Distinctive attributes of the older basin-fill sediments, commonly referred to in the literature as Payette (?) or Salt Lake (?) Formations (Piper, 1923; Anderson, 1931; Nace and others, 1961), include ubiquitous volcanic ash, heterogeneous lithologies, and interbedded volcanic flows. Stratigraphic relations and sedimentary structures indicate

intrusion, as indicated by a deformation fabric in the shell or perimeter but not in the pluton core (Todd, 1973, Compton and others, 1977). The absence of metamorphic fabrics in the Almo pluton and Immigrant Pass intrusive imply both are postkinematic intrusions (Armstrong, 1968a; Compton and others, 1977).

Miocene-Pliocene Sediments and Volcanics

Within the boundaries of the study area, Tertiary volcanic rocks are sparsely distributed and have received little study. The best exposures occur in the low hills along the north margin of the Raft River Range between Stanrod and Clear Creek, but these exposures are insignificant when contrasted with those across the valley to the north in the Jim Sage Mountains. Here, volcanic flows are extensively and continuously exposed over an area of 40 square miles.

The Tertiary volcanic rocks have been described as quartz-tridymite latites (Piper, 1923; Anderson, 1931), quartz latites (Nace and others, 1961), welded and glassy dacties (Compton, 1972, 1975), rhyolite ashflows (Miller, 1978), and andesite porphyry (Keys and Sullivan, 1979). Black, dark brown, and dark red colors predominate. Both aphanitic and porphyritic textures have been noted, as have both extrusive and intrusive contact relations. Heavy minerals include magnetite, zircon, and apatite. Thickness of individual flows is highly variable, ranging from 50 to 300 feet (Nace and others, 1961).

Age of the volcanic rocks is also variable, as is reflected in published descriptions indicating that they underlie, are interbedded with, and overlie the older basin-fill sediments with which they are commonly associated (Piper, 1973; Anderson, 1931; Nace and others, 1961; Compton,

deposition in fluvial, deltaic, paludal, and lacustrine environments in intermontane basins.

Lithologies are diverse, and vitric ash of silicic composition is a major compenent in all but the coarsest textured sediments. Lithic breccia, conglomerate, sandstone, dolomite, and silicic volcanic rock comprise the dominant lithologies (Piper, 1923; Anderson; 1931; Mapel and Hail, 1956, 1959; Nace and others, 1961; Compton, 1972, 1975). The terrigenous clastics are typically poorly sorted and strongly lithic. White, gray, green, yellow, brown, and tan colors are characteristic. Thicknesses range from 1700 to about 8000 feet. Nearly 5,000 feet was penetrated by drill holes in the nearby Raft River geothermal area, where the lower part is hydrothermally altered (Keys and Sullivan, 1979).

Correlation and age of the older basin-fill sediments within the study area remain undefined. Similar sequences are widely distributed in the region, but each may have accumulated in a separate intermountain basin notwithstanding generally similar lithologies and stratigraphy. Prominently tuffaceous, basin-fill sediments in the Grouse Creek Mountains have been dated paleontologically as Late Miocene by J.R. Firby (Compton, 1975; Compton and others, 1977). Accordingly, the older, tuffaceous, basin-fill sediments within the study area are assigned a late Miocene and Pliocene age because of strikingly similar lithologies, stratigraphy, and intimate association with volcanic rocks lithologically similar to those dated as 8.5 to 9.0 m.y. old (Armstrong, 1976).

Pleistocene Sediments

The younger, thin, basin-fill sequence was not positively identified within the study area. It is designated as the Raft River Formation in the literature (Nace and others, 1961; Keys and Sullivan, 1979). These sediments are widely distributed, although generally concealed, above the older basin-fill sediments in the nearby Raft River geothermal area (Keys and Sullivan, 1979). They also form extensive exposures in the extreme northeastern part of the Raft River Valley (Nace and others, 1961). They are dominantly unconsolidated, buff, yellow, and brown muds, silts, sands, and gravels deposited in Pleistocene lakes or fluvial-deltaic complexes associated therewith. A Pleistocene age was assigned to these sediments by Nace and others (1961) and Keys and Sullivan (1979).

Older Alluvium and Colluvium

The older alluvium and colluvium represents a composite unit whose component parts were not distinquished during mapping because of laterally variable and gradational relationships (Compton, 1972, 1975). These deposits are, in part, correlative with, and represent the proximal equivalents of, the younger basin-fill sediments, as evidenced by glacial tills and moraines at the higher elevations in the Raft River and Albion Ranges. Also included are talus deposits and perched and incised canyon-fill deposits within the mountain drainages. All of these deposits are poorly sorted and coarse textured, reflecting deviation, transportation,

and depositon by a combination of mass wasting and fluvial processes. Inasmuch as the unit is arbitrary and composite, the deposits must necessarily range from Pleistocene to Recent in age.

Younger Alluvium

The younger alluvium, occupying the drainages incised into the older older alluvial terraces and underlying basin-fill sediments, consists of terrigenous clastics derived from pre-existing deposits. The most conspicuous and largest contributors are the older alluvial terraces and underlying basin-fill which are quite susceptible to erosion and mass wasting. These deposits, therefore, consist of gradational mixtures of gravel, sand, silt, and mud within the present drainages. They are assigned a Recent age and reflect continued erosion in response to regional uplift.

Consideration of the recognition-favorability criteria of Jones (1978a, 1978b) and of Houston and Karlstrom (1980) leads to the conclusion that the Cenozoic rocks have no potential to host Proterozoic quartz-pebble or unconformity-type uranium deposits. However, Cenozoic rocks within and just west of the study area contain most of the known uranium occurrences. Most notable are the pegmatite shows in the Almo pluton (Cook, 1957), the uraniferous lignites and carbonaceous shales in Goose Creek Basin (Mapel and Hail, 1956, 1959), and the uraniferous volcanics and sediments of the older basin-fill that are hydrothermally altered in the nearby Raft River geothermal area (Keys and Sullivan, 1979), Thus, Tertiary intrusive and volcanic rocks and basin-fill sediments appear to possess some, albeit largely unknown, potential to host vein, contact metasomatic, volcanogenic, carbonaceous shale and lignite, and

possibly sandstone-type uranium deposits. Within the time and budget constraints imposed by the present study, however, it was not possible to properly assess this uranium potential nor to define prospective areas in greater detail than is indicated by the known uranium occurrences.

Within the Raft River area lack of interest in Cenozoic rocks probably stems from the fact that the Tertiary intrusives are not well mineralized, the older basin-fill sediments are generally poorly exposed and attain great thicknesses, the area is structurally complex, heterogeneous lithologies coupled with rapid lateral variations in facies renders correlations both difficult and suspect, and private land ownership is significant. From an industry point of view, lack of interest in non-producing areas stems from a preoccupation with exploration for sandstone-type deposits in producing districts, somewhat lower exploration costs therein, and the relatively simple stratigraphic and structural setting of the ore deposits. It should be noted that, except for tectonic setting, the older basin-fill sediments are not very different from sediments of similar age and geologic setting which host sandstone or carbonaceous shale uranium deposits in Wyoming, Texas, and Arizona.

METAMORPHISM, FOLDING, AND LOW-ANGLE FAULTING

Background

The Precambrian, Paleozoic, and Triassic rocks within the study area have been extensively deformed by multiple episodes of folding, metamorphism, low-angle faulting, and plutonism. A summary of these deformations, based on a synthesis of the published literature, is presented in table II. The nature and chronology of the various deformations are similar throughout the Raft River area as evidenced by the data in table II. Metamorphism of amphibolite facies is typical in rocks of the Raft River complex, but the occurrences of metamorphic assemblages which are diagnostic of metamorphic facies are rare because most of the metamorphic rocks are quartz-rich (Armstrong, 1968a; Miller, 1978). As a result, the positions of isogrades are imprecisely defined, but Armstrong (1968a) believed they probably dipped eastward before doming. Small-scale metamorphic folds and associated foliations and lineations are widespread. Many are superimposed by two or more periods of deformation. The low-angle faults are also folded in some places (Compton, 1975; Miller, 1978).

All investigators recognized at least four phases of metamorphic folding and penetrative deformation on the basis of studies of minor structures (table II). Consideration of major structures suggests at least two episodes of postmetamorphic folding. Furthermore, significant low-angle faulting preceded, accompained and followed the metamorphic deformations. Finally, not to be ignored are the superimposed but more local effects of contact metamorphism and low-angle faulting that accompained mid-and late Cenozoic deformations.

TABLE II

Synthesis of plutonism, metamorphic deformation, and low-angle faulting in the Raft River area.

	Grouse Creek and Raft River Mountains Compton (1972, 1975) & Compton and others (1977).	Albion Range Miller (1978)	Armstrong (1968a)
Plutonism			
Precambrian	Adamellite	Adamellite	Adamellite
Synkinematic	Vipont Mtn. Pluton; Middle Mtn. Injection Complex		Foliated biotite granodiorite west of Cache Peak
Postkinematic	Red Butte Pluton (25 m.y.); Immigrant Pass Pluton (38 m.y.)		Almo Pluton (30 m.y.)
Metamorphic Deformation			
Ductile phases	D1, D2, D3, D4	D1, D2, D3, D4	D1, D2, D3, D4
Deformation phases	NE, NW to W, NE, kink folds	NE, NW, dome related; kink folds (N,SE)	NE, W to NW; dome related; kink folds
Maximum deformation	D2, NW to W	D2, NW	D2, W to NW
Maximum shortening	Vertical	Vertical	Not stated
Maximum extension	Horizontal	Horizontal	Not stated
Maximum metamorphic grade	Amphibolite	Amphibolite	Amphibolite
Maximum temperature	D2	D2	D2
Age of deformations	D1 pre 38 m.y. ago; D2 25 m.y. ago	Major (D1 7 D2)-post Late Tr to Late Kr or Eocene to Miocene	Major (D1 7 D2) Early Tr to pre Late Kr; Late Kr to Oligocene
Deformation model	Kehle (1970)	Kehle (1970)	Infrastructure; suprastructure; abscherungzone
Low-Angle Faulting			
Number episodes	3	3	Multiple
Directions of displacement	W, N, E,	NW, NE, E	Not discussed
Amount of displacement	Significant (30 km)		
Number of faults	3	4	Not discussed
Number of sheets	3	4	Not discussed
Age	Pre, Syn, and Postmetamorphism	Pre, Syn,&Postmetamorphism	Not discussed
Autochthonous sequence	Archean & Precambrian Z (?)	Archean & Precambrian X (?)	Not discussed
Allochthonous sequence	Upper Narrows through Oquirrh	Yost through Oquirrh	Not discussed
Most Deformed sheet	Lowest (sheet 1)	Lowest (sheet 1)	Not discussed
Type	Younger-on-Older	Younger-on-Older	Younger-on-Older

Ductile Deformation

Based on studies of minor structures at least four phases of ductile deformation can be recognized (table II). Two of these ductile phases occur regionally, as evidenced by small-scale folds and associated penetrative fabrics having widespread distribution in rocks of both the autochthon and allochthons (Armstrong, 1968a; Compton, 1972, 1975; Compton and others, 1977; Miller, 1978). The first, or oldest, set of metamorphic structures (D1) consists of overturned to recumbent, isoclinal, or tight folds, and related mineral foliation and lineation. Fold axes and mineral lineations trend northeast. Folds are overturned to the northwest, and axial planes and penetrative foliation intersect bedding at very low angles. Fabric geometry and vergence of folds signify metamorphic flowage to the northwest or west (Compton and others, 1977; Miller, 1978).

The second or younger set of metamorphic structures (D2) likewise consists of folds and related mineral foliation and lineation which trend generally northwest. Fold styles range from isoclinal to broad and open. Overturning is dominantly to the northeast, but Compton and others (1977) also noted overturning to the southwest in this set. According to Miller (1978) foliation parallels D2 axial planes and dips steeply. Mineral grains and pebbles and cobbles in conglomerates are conspicuously elongated parallel to fold axes and flattened in the plane of bedding (Compton, 1975; Miller, 1978). From the published literature, D2 structures are apparently the most pervasive and occur widely in both the autochthon and allochthon. They

record the maximum stress of regional metamorphism (Armstrong, 1968a; Compton and others, 1977; Miller, 1978). Peak metamorphic temperatures were probably achieved during this deformation phase, as indicated by the associated highest grade assemblage of metamorphic minerals (Miller, 1978).

Metamorphic structures distinctly younger than the second set (D2) occur throughout the Raft River area and include small-scale folds and penetrative fabrics. These structures probably reflect more of the local rather than the regional metamorphic deformation because they are not as widely distributed as D1 and D2 and differ somewhat in character from one place to another. In the northern part of the Albion Range, Miller (1978) interpreted D3 structures to be related to the formation and rise of Big Bertha dome and concomittant flowage of the overlying metasedimentary rocks outward away from the apex of the dome and downward toward the adjacent rim synclines or basins. This interpretation derives from his observations of the geometry of D3 folds and their close spatial relation to Big Bertha dome. Miller's (1978) D4 folds are minute (1 mm) kink folds that have been superimposed on all earlier metamorphic structures. D4 axes trend generally N 15° E, axial planes are nearly vertical, and sense of vergence is not systematic (Miller, 1978). They definitely post-date formation of Big Bertha dome because orientations are unaffected by it. Kink folds with comparable trends but systematic eastward vergence were noted by Compton and others (1977) in the Utah portion of the study area where they were considered to be associated with late eastward movement on low-angle faults.

Armstrong (1968a) also observed D3 and D4 metamorphic structures in the Albion Range (table II). D3 structures were described as northwest trending

folds with southwest dipping, axial plane foliation. Because of their geometry and spatial relation to Big Bertha dome, Armstrong (1968a) interpreted them to be contemporaneous with and genetically related to dome formation but outlasting it in time of development. Armstrong (1968a) also observed sporadic north-south trending kink folds, noted their association with retrograde metamorphism, but did not offer an interpretation of their significance.

In the Utah portion of the study area, specifically in the Raft River, Dove Creek, and Grouse Creek Mountains, Compton and others (1977) observed scarce D3 metamorphic folds with axes trending generally northeast and limbs overturned either northwest or southeast. Is some areas these folds are related to small imbricate "thrust" faults which moved hanging wall rocks northeastward and eastward relative to the footwall (Compton and others, 1977). Kink (crimp) folds were also noted and interpreted to signify deformations attending eastward movement of allochthonous sheets on low-angle faults (Compton, 1975).

None of the original investigators, or the writer for that matter, envisions the metamorphic deformations evidenced by the minor structures and penetrative fabrics to represent four separate and distinct metamorphic events. Rather, metamorphic deformation is visualized as a single protracted event during which the various fabrics developed in rocks with differing rheological properties in response to changing temperature and stress fields. Thus, D1 structures evolved during the early period of increasing temperature and stress, D2 structures record maximum temperature and stress, and D3 structures reflect declining temperature and variable local stress which prevailed during the waning phase of regional metamorphism

and deformation. According to Armstrong (1968a), D4 structures, the kink folds, signify retrograde metamorphism and deformation under conditions of substantially lower temperature and stress.

As was noted by Compton and others (1977) and Miller (1978), the metamorphic minerals, fold forms, and vertical distributions of strains in rocks affected by the first and second (D1 and D2) metamorphic deformations are so similar and widely developed as to suggest that one followed the other closely. D3 structures, on the other hand, differ sufficiently in their character and distribution to imply more localized stress-dominated deformation, such as that accompanying formation and rise of the individual mantled gneiss domes. There are at least seven of these. Thus, D3 structures signify deformation in the metasedimentary rocks overlying the domes as a consequence of flowage outward away from the apex of the rising domes, and downward toward adjacent rim synclines or basins.

Kink folds, as interpreted by Armstrong (1968a), and Compton and others (1977), and implied by Miller (1978), signify the waning phase of metamorphic deformation in a cooler, more rigid pile of metasedimentary rocks undergoing, simultaneously, regional uplift and eastward movement on low-angle faults.

Post-metamorphic Folding

Post metamorphic folding, faulting, and intrusion was widespread and variable and affected rocks of both the autochthon and allochthon. During the waning stages of metamorphism and prior to depositon of the upper Miocene and Pliocene sediments, and associated volcanics, allochthonous rocks, especially the Oquirrh Formation, were rather strongly folded, and rocks of the autochthon were buckled moderately in many places (Compton,

1972, 1975; Compton and others, 1977). The earlier postmetamorphic folds trend N. 30° E. to N. 35° W. and are overturned toward the east. According to Compton (1975), some low-angle faults were folded at this time while others, notably the upper and presumably youngest, experienced considerable movement as evidenced by juxtaposition of unmetamorphosed and metamorphosed rocks. Erosion of these folds and allochthonous sheets, accompanied by volcanism, led to the formation of the widely distributed, thick, basin-fill sediments, and volcanics of late Miocene and Pliocene age. Compton and others (1977) noted a widespread, consistent, inverted, clast stratigraphy in these sediments and interpreted it to mean the allochthonous sheets had not been subjected to extensive high-angle faulting at this time.

Subsequently, the late Miocene and Pliocene basin-fill sediments and older rocks were folded, mostly on north-south axes, but locally on east-west axes, to form the present mountain ranges. As the anticlinal character of the major ranges evolved, considerable arching, doming, and vertical uplift occurred along high-angle basin-and-range type faults. Low-angle faults which juxtapose metamorphosed and unmetamorphosed Paleozoic rocks on upper Miocene and Pliocene basin-fill sediments probably accompanied this deformation.

Low-Angle Faults

Low-angle faults with diverse senses of movement and variable but demonstrably large lateral displacements are distinctive structural features throughout the Raft River area (table II and plate 1). They preceded, accompanied, and followed the major metamorphic deformations.

Faulting consists dominantly of thrusting of younger rocks over older rocks and therefore suggests, as do the minor structures formed during the D1 and D2 metamorphic deformations, that considerable extension accompanied deformation in the Raft River area. This is evident in the near parallelism of the low-angle faults, bedding, D1 foliations and axial planes, and D2 elongation and flattening of both mineral grains and conglomerate clasts in the plane of bedding (Compton, 1972, 1975; Miller, 1978). Low-angle thrust faults are known, but they are uncommon and typically involve recumbent fold limbs or locally juxtaposed allochthonous sheets, as was noted by Compton and others (1977) and Miller (1978).

Substantial lateral displacements along some of the low-angle faults are indicated by tectonically eliminated thick stratigraphic successions, by significant metamorphic discontinuities between juxtaposed allochthonous sheets or between allochthon and autochthon, by the greatly abbreviated and highly attenuated Precambrian Z (?)-Paleozoic stratigraphic section, and by the presence of an atypical Cambrian (?) sequence (Compton, 1973, 1975: Compton and others, 1977; Miller, 1978).

Considerable low-angle faulting apparently predates or possibly coincides with the early metamorphic deformation. This is evidenced by the general absence of breccia or phyllonite in the fault zones; by parallelism of fault planes, bedding, and the major D1 foliation; by the lack of discontinuities in metamorphic grade or in orientation of minor structures across many of the faults; and by comparable mineral assemblages and metamorphic fabrics near and within fault zones (Compton and others, 1977; Miller, 1978). Direction of tectonic transport during this early phase of low-angle faulting

must be inferred from minor structures formed during D1 deformation. Style and vergence of D1 folds suggest metamorphic flowage and accompanying tectonic transport on contemporaneous low-angle faults was northwestward or westward approximately parallel to bedding (Compton and others, 1977; Miller, 1978). The amount of displacement is unknown.

Low-angle faulting contemporaneous with metamorphism is indicated locally by a phyllonitic (recrystallized cataclastic rock) schist overlying the Elba Quartzite (Compton, 1975). This schist is locally crimped and buckled on axes that trend east-west, and near the head of Indian Creek Canyon is truncated by low-angle faults that strike east-west and dip 30° south (Compton, 1975). Compton (1975) interpreted the asymmetry of associated metamorphic folds (D2) to indicate movement from south to north on the "thrusts".

Considerable post-metamorphic, low-angle faulting is evident throughout the Raft River area. Unmetamorphosed Oquirrh Formation rocks are juxtaposed along low-angle faults with metamorphosed equivalents. Moreover, the highest grade metamorphic rocks of the allochthon tectonically overlie the lowest grade metamorphic rocks of the autochthon. Finally, both metamorphosed and unmetamorphosed Paleozoic rocks are tectonically juxtaposed with upper Miocene and Pliocene basin-fill sediments, but these particular low-angle faults probably developed in Pliocene time in response to arching, doming, and uplift of the mountain ranges along high-angle faults. Tectonic transport along the postmetamorphic low-angle faults was eastward, as is evidenced by north-south trending folds with eastward overturning and associated imbricate "thrusts" and also by the sense of offset on associated strike-slip faults (Compton, 1972). Contrasts in metamorphic grade of

juxtaposed rocks suggest horizontal displacements of at least 30 km on some low-angle faults of postmetamorphic age (Compton and others, 1977).

Dating of Deformational Events

Dating of these various deformations in the study area is hindered by extensive erosion and cover, widespread Tertiary heating, and seemingly ambiguous field relations and radiometric age dates. Stratigraphic criteria, depositional patterns and characteristics, ages of synkinematic and postkinematic intrusions, and "cooling" ages (K-Ar dates) of metamorphic minerals and rocks have been utilized by various workers to develop a regional synthesis of orogenic activity in the eastern Great Basin (Misch, 1960; Stokes, 1960; Misch and Hazzard, 1962; Armstrong and Hansen, 1966). All of the syntheses rely on the application of scattered bits of evidence from several areas to the region as a whole, which presumes the orogenic and plutonic activity were regional in extent and coeval throughout the entire region. The writer concurs with Miller (1978) who urged caution in extrapolating data from one area to another.

Considerations of regional stratigraphy place a lower, or older, limit on the age of regional metamorphism and deformation in the eastern Great Basin. Misch and Hazzard (1962) outlined the evidence for metamorphism and deformation of the upper Precambrian through lower Triassic rocks in eastern Nevada, and they argued that the regionally extensive and conformable sequence precludes an age older than early Triassic for a regional orogenic event. While it is acknowledged that this sequence is nowhere completely

intact in the Raft River area, and therefore conformity may be questioned, this same argument is adopted because most, and perhaps all, of the recognized rock systems are represented and generally occur in their proper stratigraphic order, except where tectonically eliminated along low-angle faults or stratigraphically inverted due to recumbent folding (table I).

An upper, or younger, limit on the age of regional metamorphism and deformation in the study area might likewise be inferred from regional stratigraphic evidence. This is, however, a much more tenuous approach. According to Armstrong and Hansen (1966), lower Cretaceous rocks unconformably overlie deformed Paleozoic rocks in several areas of eastern Nevada, suggesting that regional deformation had ceased by early Cretaceous time. Inasmuch as these lower Cretaceous rocks have a very restricted distribution, compared with the conformable late Precambrian through early Triassic rocks, they may have accumulated in local basins rather than in the regionally extensive Cordilleran geosyncline. Thus, deep deformation and regional metamorphism may have continued considerably longer, as was recognized by Miller (1978). Within the study area, there are no Mesozoic rocks younger than the Lower Triassic marine limestone mentioned by Todd (1973). Evidence will be presented subsequently which illustrates the fallacy of extrapolating data from one locality to another, as might be done here, to fix an upper age limit on deformation and metamorphism.

Postkinematic plutons which have been dated radiometrically occur at a number of localities in eastern Nevada as well as within the Raft River area. Because these plutons cut across orogenic structures and regionally metamorphosed upper Precambrian and Lower Paleozoic rocks, radio-

metric dates on them permit a refinement in interpretation of age of deformation and regional metamorphism. The age data summarized by Armstrong and Hansen (1966) and Armstrong (1972, 1975, 1976) clearly indicate that regional metamorphism and deformation in eastern Nevada was concluded by early Cretaceous time. These and more recent radiometric age data are summarized in table III and will be discussed in more detail later.

Within the Raft River area, both synkinematic and postkinematic plutons are known and radiometrically dated. The Vipont Mountain intrusion and the Middle Mountain injection complex, both located in the Grouse Creek Mountains, are synkinematic intrusions as evidenced by distinct lineations with trends parallel to D2 metamorphic structures in adjacent country rocks (Compton and others, 1977; Armstrong, 1976). Both of these intrusions occur in the westernmost, highest metamorphic grade exposures of the autochthon. Compton and others (1977) were unable to obtain unambiquous age data for the Vipont Mountain pluton. However, Armstrong (1976) reported Oligocene Rb-Sr ages for the Middle Mountain injection complex. Thus, the second (D2) metamorphic deformation in the Grouse Creek Mountains, and probably elsewhere in the study area as well, was apparently still underway during Oligocene time. This conclusion is supported by geologic relations and age dates of postkinematic plutons.

Postkinematic plutons also occur in the study area and include the Immigrant Pass intrusion, Almo pluton, and Red Butte stock. The Immigrant Pass intrusion and Red Butte stock are located in the Grouse Creek Mountains, whereas the Almo pluton is located in the Albion Range. Their

LOCATION	POST KINEMATIC INTRUSION		METAMORPHIC MINERAL		REFERENCE
	K-Ar	other	K-Ar	Other	
NEVADA					
Dolly Varden Mts.	125 (b+h)				Armstrong & Hansen, 1966
HD Range	150	160 (Pb-)			Riva, 1970
	147, 140				McDowell, 1971
Delano Mts.	135 (b)				Slack, 1974
Schell Creek Mts.			39 (wr)		Mauger and others, 1968
Deep Creek Mts			20-22 (3)		Mauger and others, 1968
Ely area	109 (6)				McDowell and Kulp, 1967
Ruby Mts.			43-18		Thorman, 1965
			25-29 (2)		Mauger and others, 1968
		110, 35 (24) (Rb-Sr)			Kistler & Wilden, 1969
	32				Armstrong, 1970
Southern Snake Range	125, 105 (b)				Armstrong & Hansen (1966)
			219-13 (3)	36 (ft)	Snoke, 1975
	154 (m)				Snoke, pers. comm., 1978
Snake Range	125, 105 (b)		27-40 (4)		Mauger and others, 1968
	151-17 (28)	220-40 (Pb-)	259-22 (9)		Lee and others, 1970
		151-90 (Rb-Sr)			Lee and others, 1970
	81, 82 (m)				Armstrong & Suppe, 1973
RAFT RIVER COMPLEX					
Albion Mountains					
Almo Pluton	23-25 (2)				McDowell, 1971
	22-16 (19)	28 (wr, Rb-Sr)			Armstrong, 1976
		30 (wr, Rb-Sr)			Armstrong and Miller (1967)
metasediments			162-24 (20)		Armstrong, 1976
migmatites			80-16 (11)	29-16 (Rb-Sr)	Armstrong, 1976
Raft River Mts.					
metasediments			41,38 (b)		Mauger and others, 1968
Grouse Creek Mts.					
plutons		38 (wr, Rb-Sr)			Compton and others, 1977
		25 (wr, Rb-Sr)			Compton and others, 1977

Table III. Radiometric age determinations of postkinematic plutons and of metamorphic rocks and minerals in the eastern Great Basin and the Raft River area

Rb-Sr whole-rock ages are 38, 30 and 25 m.y., respectively (Compton and others, 1977); Armstrong and Hills, 1967). Geologic relations within and adjacent to the Red Butte stock are instructive. Aligned biotite crystals define a weak foliation, and biotite, quartz, and feldspar crystals impart a faint lineation in the shell or perimeter, but not in the core of the body (Todd, 1973; Compton and others, 1977). Over a horizontal distance of 460 meters below the middle allochthonous sheet, the intrusion is strongly gneissose, marked by microfolds and lineated mineral grains, and mylonitized, with fabric elements paralleling those of the second (D2) metamorphic deformation in nearby country rocks (Compton and others, 1977). Thermal metamorphism of rocks in the middle sheet is both pronounced and conspicuous over a distance of 750 meters from the stock but rocks of the upper sheet, located only 200 meters above the pluton, exhibit no thermal metamorphism, according to Compton and others (1977). From these observations, Compton and others (1977) concluded that intrusion and crystallization of the Red Butte stock coincided with movement on the middle low-angle fault and with the second (D2) metamorphic deformation but predated emplacement of the upper allochthonous sheet.

Geologic relations in and adjacent to the other postkinematic plutons are informative but yield less definitive and even somewhat ambiguous results. The Immigrant Pass intrusion, previously named the Grouse Creek pluton by Baker (1959), intruded and metamorphosed rocks of the middle allochthonous sheet. It cuts across northeast-trending metamorphic folds of the first (D1) set, and is overlain tectonically (?) by unmetamorphosed rocks of the upper sheet (Compton and others, 1977). The age relation between the pluton

and the younger (D2) set of metamorphic folds was not established, although the pluton exhibits no metamorphic fabrics (Compton and others, 1977). Armstrong (1970) obtained a K-Ar biotite age of 23 m.y. on granodiorite from the northwestern lobe of the Immigrant Pass intrusion, but it is not known whether this age reflects primary crystallization or later heating. Interpretation of these geologic relations leads to the conclusion that intrusion and crystallization of the Immigrant Pass pluton followed the first (D1) metamorphic deformation and the emplacement of the middle (and presumably the lower) allochthonous sheet but apparently preceded movement along the upper low-angle fault and emplacement of the upper allochthonous sheet.

Several other bits of information bearing on the ages of deformation and regional metamorphism in the studyarea merit discussion. The Almo pluton, dated by Rb-Sr methods at 30 m.y., exhibits no penetrative deformation but cuts across metasedimentary rocks with D1 and D2 fabrics in the Albion Range (Armstrong and Hills, 1967). K-Ar ages on metamorphic minerals developed in association with the intense D2 phase range from 70 to 80 m.y., dating the second metamorphic deformation as somewhat older than late Cretaceous (Armstrong and Hills, 1967).

Consideration of the age data summarized in table III reveals a wide range of radiometrically determined ages (from Jurassic to middle Tertiary) for metamorphic minerals and rocks in the eastern Great Basin, including the Raft River area. The predominance of young dates, approximately 100 m.y. younger than the age of metamorphism and deformation inferred on stratigraphic evidence, is noteworthy. Armstrong and Hills (1967) and Mauger and others (1968) interpreted this discrepancy to mean that the rocks had experienced an early protracted high temperature history and a late cooling phase immediately before or during Basin and Range uplift. This interpretation

is compatible with data from the study area. Fission track ages on sphene and apatite from Precambrian W adamellite and schist and from Ordovician marble (Pogonip) in the Raft River Range suggest that these rocks were at metamorphic temperatures (400° C) as recently as Miocene time (Compton and others, 1977). Chemical mobility and, presumably, elevated temperatures also existed in late Miocene time in the Grouse Creek Mountains as evidenced by 8 to 11 m.y. old Rb-Sr biotite whole-rock ages on Precambrian W adamellite (Compton and others, 1977).

Interpretation of the previously described geology, field relations, and radiometric age data to yield a consistent chronology of deformation events in the Raft River area is obviously not without ambiguity. Collectively speaking, however, the data and observations permit the conclusion that major deformation and metamorphism occurred sometime during late Triassic to late Cretaceous time and that minor metamorphic deformation, recrystallization, diffussion, isotopic exchange, and elevated temperatures continued from late Cretaceous until late Miocene time. Metamorphic folds and penetrative fabrics developed during the first phase (D1) of ductile deformation clearly predate intrusion of the 38 m.y. old Immigrant Pass pluton since, according to Compton and others (1977), the intrusion cuts across early metamorphic folds in the southern Grouse Creek Mountains. Moreover, this early phase of metamorphic deformation probably occurred sometime during the interim late Traissic to pre-late Cretaceous time based on considerations of regional and local stratigraphy, Jurassic age dates on metamorphic minerals from rocks within and beyond the study area, relative ages of D1 and D2 fabrics, and the late Cretaceous K-Ar ages of D2 minerals in the Albion Range.

The second (D2) phase of ductile deformation must be somewhat older than late Cretaceous age, based on K-Ar ages of D2 metamorphic minerals, but apparently continued at least locally, until late Oligocene time, as evidenced by geologic relations within and adjacent to the 25 m.y. old Red Butte stock. Both this interpretation and those of previous investigators ignore the ambiguity created by the absence of a regional D2 fabric in the 38 m.y. old Immigrant Pass intrusion. A satisfactory explanation is obviously lacking. Perhaps the penetrative fabric in the shell or perimeter of the Red Butte stock merely reflects a local continuation of a previous regional stress. Notwithstanding this explanation, however, the ambiguity still remains, because the Middle Mountain injection complex exhibits the D2 fabric and also yields Oligocene Rb-Sr age dates (Armstrong, 1976).

Geometry and spatial distribution of D3 structures indicate that they are local structures related to formation and uplift of the various gneiss domes (Armstrong, 1968a; Miller, 1978). Strong vertical uplift and doming during late Tertiary time is also recorded by the areally widespread and consistent, inverted, clast stratigraphy recognized by Compton and others (1977) in the upper Miocene and Pliocene basin-fill sediments. Significant uplift and erosion is likewise indicated by the presence of Pliocene volcanics resting on metamorphosed rocks in the Albion Range (Miller, 1978). Incipient doming and vertical uplift, therefore, predate upper Miocene sediments and volcanics and are probably related to postkinematic intrusions of Oligocene age, as suggested by Miller (1978).

The kink folds necessarily postdate formation of the gneiss domes because they are unaffected by the domes (Miller, 1978). They probably formed

during extensive low-angle faulting and eastward tectonic transport which emplaced unmetamorphosed Paleozoic rocks sometime during the interim 10 to 25 m.y. ago. This is compatible with the observations of Armstrong (1968a) who believed that they developed during the waning stages of deformation and reflected retrograde metamorphism. Continued uplift and erosion during Pliocene and Pleistocene time is indicated by folded Miocene and Pliocene basin-fill sediments, the youthful topography and deep dissection of the mountain ranges, and numerous basin-and-range type faults with significant vertical displacements.

Considerable low-angle faulting is inferred to have predated metamorphism, for the reasons previously described. Thus, a late Triassic to possibly late Cretaceous age, is implied for the lower and, presumably, older allochthonous sheet. Movement of the middle sheet necessarily occurred before 38 m.y. ago, continued during middle Tertiary time, and presumably ceased shortly after 25. m.y. ago. The Upper sheet, consisting mainly of unmetamorphosed Oquirrh Formation and younger rocks, was clearly emplaced after the metamorphic fabrics and mineral assemblage developed. Eastward movement was probably accomplished largely after 25 m.y. but before deposition of upper Miocene and Pliocene basin-fill sediments and volcanics, as suggested by the inverted clast stratigraphy.

The low-angle faults along which metamorphosed and unmetamorphosed rocks are juxtaposed with upper Miocene and Pliocene basin-fill sediments are probably very young and related to arching, doming, and uplift of the major mountain ranges along high-angle faults. These low-angle faults are probably Pliocene in age and formed early during the latest phase

vertical tectonics that occurred along the high-angle basin-and-range type faults. The high-angle faults cut upper Miocene and Pliocene sediments, Pliocene volcanics, and Pleistocene basin-fill sediments and are, therefore, Pliocene to Recent in age.

Elevated temperatures have affected the metamorphosed and deformed rocks of the Raft River complex for nearly 200 m.y. and only in the last 10 m.y. or so, in response to pronounced vertical uplift and rapid erosion, have the deformed rocks cooled below metamorphic temperatures. Locally, elevated temperatures persist at depth in the basement complex, as is evidenced by the nearby moderate-temperature Raft River geothermal field. The geothermal potential of metamorphic core complexes is an intriguing but unevaluated subject.

Geologic History Summary

A synthesis of major geologic events in chronological order may assist the reader in comprehending the maze of geologic data presented in preceding sections of this report. The geologic history involves lengthy periods of subsidence and sedimentation punctuated by deformations of orogenic intensity. The resulting complexities are greater than elucidated in the following brief comments. Perhaps the most noteworthy aspect of the geologic history is the lengthy period, approximately 200 m.y., for which these rocks were subject to metamorphic temperatures (400 to 500° C or higher).

The geologic history represented in the Raft River area began sometime before 2.5 b.y. ago with deposition of texturally and compositionally immature Archean sediments consisting predominantly of argillaceous, feldspathic, and quartzose sands, silts, muds, and pebbly to cobbly muds, and subordinate tuffs and flows of mafic composition. Thickness of Archean sediments locally exceeds 300 meters (1000 ft.) but is otherwise unknown. Deposition was probably in low to moderate energy environments in a marine basin of unknown, but probably regional, extent. Sometime after deposition the sediments were deformed, first by intrusion of sills, dikes, and plugs of diabase and gabbro, and subsequently by adamellite bodies of batholitic dimensions (2.5 b.y.). Regional metamorphism accompanied, or followed, regional plutonism. Significant uplift and erosion thereafter resulted in development of a profound regional unconformity on rocks of the Green Creek Complex.

Sometime following 2.5 b.y. ago terrigenous sedimentation began on the deformed, stabilized, and eroded perimeter of the Archean craton. Feldspathic and quartzose sands, quartzose conglomerate, silts, and muds accumulated to thicknesses exceeding 650 meters and formed what appears to be a dominantly transgressive marine sequence, with perhaps minor regressive episodes represented by the conglomerate member of the Elba and Yost Quartzites. Between deposition of the Precambrian Z (?) sediments (lower subgroup rocks) and deposition of the Precambrian X (?) sediments (middle subgroup rocks), a gap occurs in the geologic record of the Raft River area because nowhere are these rocks observed in contact with each other. Thus, during this period of time the geologic history must be inferred from considerations of regional geology. Obviously, the inferred events may not have occurred in the study area.

About 1.6 to 1.7 b.y. ago the inferred correlatives of the Green Creek Complex and the Precambrian X (?) subgroup, the Farmington Canyon Complex and the Facer Creek Formation, respectively, in central and northeastern Utah, were deformed and metamorphosed. These rocks were subsequently uplifted and eroded. They presumably served as the source for the thick (4900 meters) terrigenous clastics of Precambrian Y age,the Big Cottonwood-Uinta Mountain sequence, which accumulated in an east-west trending basin coincident with central Wasatch Range and the Uinta Mountains. Following deposition these rocks were folded, uplifted, and eroded.

Well dated and regionally correlated, thick (4,500 - 7,600 meters) Precambrian Z sequences were derived from the deformed and uplifted older Precambrian rocks. This is evidenced by distinctive lithologies in clasts

of the Precambrian Z conglomerates, tillites, and diamictites, and by the commonly observed angular discordance between the Precambrian Z rocks and the older Precambrian rocks upon which they rest. Except for local or regional disconformities, the Precambrian Z, Paleozoic, and Triassic rocks form a regionally extensive and generally conformable sequence throughout the eastern Great Basin, attaining composite thicknesses greater than 15,000 meters. The Precambrian Z rocks are mostly terrigenous sediments, whereas the Paleozoic and Triassic rocks are dominantly carbonates. Deposition was largely in low to high energy marine environments of the Cordilleran miogeosyncline. Deep subsidence and thick marine sedimentation were the dominant processes 200 to 800 m.y. ago.

By early Triassic time the base of the Precambrian was already subjected to metamorphic temperatures, assuming a normal geothermal gradient of 30° C/km, and deformation was probably already in progress. Low-angle faulting preceded and/or accompanied slow regional uplift, and metamorphic flowage commenced to produce the D1 structures and fabric sometime during late Triassic and early Jurassic time. Continued regional uplift, increasing temperature, and changing stress during Early Jurassic to Late Cretaceous time promoted continued low-angle faulting and metamorphic flowage that facilitated development of the D2 structures and fabric. Thus, considerable low-angle faulting and most of the regional metamorphic deformation occurred during Late Triassic to Late Cretaceous time, during which time significant regional uplift and thinning, both tectonic and erosional, of the Paleozoic and Mesozoic cover also took place.

Within the Raft River area, metamorphic temperatures, low-angle faulting, intrusion, and, at least locally in the Grouse Creek Mountains,

D2 deformation continued from Late Cretaceous through Oligocene time. During Late Oligocene to Early Miocene time, postkinematic plutons penetrated to sufficiently shallow levels, to cause the still hot and plastic gneisses and schists to dome above them. This caused flowage outward away from the apex of the rising gneiss domes and downward toward adjacent rim synclines and basins. Strong uplift, continued folding, significant low-angle faulting with eastward movement of allochthonous sheets, and widespread volcanism were largely contemporaneous deformations during Late Oligocene and Miocene time.

Rapid uplift and tectonic unroofing initiated cooling and increased erosion. This also led to deposition of extensive, thick (2,500 meters), volcaniclastic, fluvial-lacustrine sequences of late Miocene and Pliocene age. High-angle faulting was not pronounced during early sedimentation, as is suggested by the widespread and consistent inverted clast stratigraphy in these sediments, but it assumed increasing importance thereafter. Arching and doming of the major ranges continued along high-angle faults during Pliocene and Pleistocene time. During the early phase of strong uplift, low-angle faults developed along lithologic or structural discontinuities and facilitated tectonic denudation of the ranges and emplacement of allochthonous sheets on upper Miocene and Pliocene basin-fill sediments. Continued uplift along high-angle faults and accompanying erosion during Pleistocene and Recent time produced the present landscape.

POTENTIAL HOST ROCKS

Background

Recognition of uraniferous conglomerate and quartzite in metasedimentary sequences in the Medicine Bow-Sierra Madre Mountains of Wyoming by Graff and Houston (1977) and in the Black Hills of South Dakota by Hills (1977) prompted BFEC geologists to conduct literature studies and a brief field reconnaissance of other areas in the Wyoming Precambrian Province. Selection of the Raft River area for study was based on reported occurrences of Archean, or Precambrian W, metasedimentary and granitic rocks, the presence of a profound regional unconformity between Archean rocks and overlying Precambrian X (?) metasedimentary rocks, and published descriptions of Precambrian X (?) pebble conglomerates and quartzites generally similar in character to those of the Elliot Lake and Blind River areas. The target lithologies selected for emphasis during the field reconnaissance and geochemical sampling, listed in decreasing order of priority, included the conglomerate and quartzite facies of the Green Creek Complex, the Elba Quartzite, and the Yost Quartzite. Secondary targets that might host other types of uranium deposits included the Archean adamellite and the paleoregolith at the base of the Elba Quartzite.

The primary objective of the present study was acquisition of sufficient geologic, radiometric, and geochemical data to evaluate the potential of the high priority target lithologies to host Proterozoic quartz-pebble conglomerate uranium deposits. The methods of investigation utilized to achieve this objective included field reconnaissance, measurement, and select sampling of stratigraphic sections of the target units,

measurements of natural radiation, and areal geochemical sampling of target units, stream sediments, and surface waters (streams, springs, and a few shallow wells). The results of the field reconnaissance and the measured stratigraphic sections are reported in the following pages whereas the results of the geochemical sampling are discussed in a subsequent section. The distribution of major lithostratigraphic units of Precambrian W and X (?) age are shown on plate 1.

Green Creek Complex

Armstrong (1968a) proposed the formal name Green Creek Complex for exposures of gneiss, schist, amphibolite, and minor quartzite that crop out in Green Creek on the northeast side of Cache Peak in the Albion Range. Excellent exposures of the various lithologies also occur in all of the deep canyons in the eastern half of the Raft River Mountains (plate 1). Adamellite, or adamellite gneiss, composes approximately 75 percent of the crystalline basement complex, and metasedimentary rocks, trondhjemite, pegmatite, and mafic metamorphic rocks constitute the remaining 25 percent. Locally, any of the subordinate lithologies may predominate. They typically comprise blocks and slabs of variable dimensions folded into, or partially to completely engulfed by, adamellite or adamellite gneiss.

Throughout the study area the most common lithology in the Green Creek Complex is a tan-weathering adamellite or adamellite gneiss (plate 1). Fresh surfaces are light gray. In the least metamorphosed exposures in the eastern Raft River Mountains, the adamellite exhibits a phaneritic hypidiomorphic, granular texture, locally grading to porphyritic, with aligned biotite flakes imparting a faint foliation and lineation (Compton, 1975). In contrast, the most metamorphosed exposures in the Grouse Creek and Albion Mountains consist of porphyroblastic adamellite gneiss (Armstrong, 1968a; Todd, 1973). According to Armstrong (1968a),

Todd (1973), and Compton (1972, 1975), the major megascopic minerals are biotite, white mica, quartz, plagioclase, and microcline. Accessory minerals reported by Todd (1973) and Compton and others (1977) include ilmenite, rutile, sphene, allanite, zircon, monazite, apatite, garnet, and epidote. White mica and epidote are products of metamorphism (Todd, 1973; Compton and others, 1977). Felix (1956) reported magnetite, but Todd (1973) did not detect any in a suite of 12 samples.

Metasedimentary rocks comprise between 10 and 15 percent of the Green Creek Complex (plate 1). At least three sedimentary facies can be recognized on the basis of texture, sedimentary structures, and composition (Compton, 1975). The most widely distributed and thickest facies consist of silty and sandy shale, now variably metamorphosed to quartz-mica schist. The other two facies are quite subordinate by comparison and include argillaceous, feldspathic, and quartzose sandstone, now metamorphosed to mica-quartz schist and quartzite, and a pebbly and cobbly mudstone, metamorphosed to conglomeratic schist. No clast supported conglomerates were reported or observed anywhere in the Green Creek Complex. Quartzites represent a minor lithology and are, generally speaking, indistinguishable from those in younger metasedimentary units, as noted by Armstrong (1968a). They are commonly small scale, crossbedded, thin to thick bedded, moderately sorted, and medium to coarse grained. They typically weather to shades of brown, and fresh surfaces are usually tan, white, or gray. Deposition of the quartzites probably occurred in a nearshore marine environment.

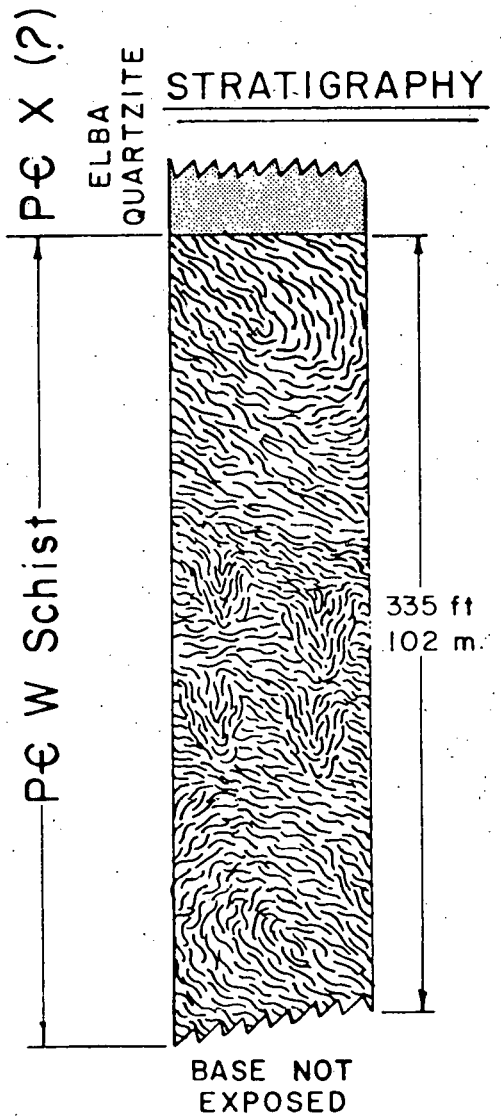
The predominant lithology in the metasedimentary rocks is a brown,

weathered, silvery, mica-rich schist (plate 1). Other lithologies recognized and described by Armstrong (1968a) and Compton (1972, 1975) include muscovite-biotite-quartz schist, quartz-mica schist, and biotite schist. The accessory mineral suite is largely unknown, although Compton and others (1977) reported sphene and apatite in samples of schist collected for fission track dating. Samarskite occurs in quartz-feldspar metamorphic segregations and in pegmatites of Archean schist and Oligocene adamellite (Bill Gallant, oral communication, 11/13/79).

Textural and compositional considerations suggest that the finer-textured metasedimentary rocks were deposited, for the most part, in a low energy, offshore marine environment. The pebbly and cobbly mudstones may represent ice-rafted debris or a submarine massflow deposit resulting from failure and mixing of interbedded gravels and muds which accumulated on unstable slopes.

Thickness of the Archean metasedimentary rocks is highly variable throughout the Raft River area. The thicker, more continuous exposures occur in the deeper canyons in the eastern half of the Raft River Mountains, notably in Jim, Rice, Tenmile Creek, and Indian Creek Canyons. In this area access is limited because of private land ownership. Nowhere is a complete section of Archean metasedimentary rocks preserved. Exposures generally represent incomplete sections folded into, or engulfed by, younger intrusions of amphibolite, trondhjemite, pegmatite, or adamellite. Compton (1972, 1975) reported minimum thicknesses of 91 meters (300 feet) and 305 meters (1,000 feet) in the Yost and Park Valley quadrangles, respectively. The writer measured 102 meters (335 feet) in Tenmile Creek Canyon, where the top is unconformably overlain by the Elba Quartzite and the base is not exposed (fig. 5). At this locality the canyon walls

SCHIST SECTION
LOCATED IN
TENMILE CREEK CANYON
EASTERN RAFT RIVER MOUNTAINS
>102 m. (335 ft.)



DESCRIPTION

Schist: Mostly fine-grained, biotite, muscovite, quartz, and feldspar; silvery, greenish, or olive-brown weathering; platy; locally phyllitic; very small-scale kink folds pervasive; isoclinally folded, recumbent, light gray, quartz and quartzite lenses, ubiquitous; only partial section, as base nowhere exposed; no other lithologies of any consequence noted in this section.

Figure 5.

consist of brown weathering,olive gray mica-rich phyllites and "phyllitic" schists with pervasive, small scale,kink folds, and less common, but ubiquitous, isoclinally folded lenses of gray quartz and quartzite.

Metamorphic grade and deformation in the Green Creek Complex varies systematically, both laterally and vertically, in the study area. Metamorphic grade is lowest in the eastern Raft River Mountains, and from here it increases systematically westward to the Grouse Creek and Albion Mountains, where amphibolite grade prevails. Since most of the metamorphic rocks are quartz-rich, occurrences of mineral assemblages which are diagnostic of metamorphic facies are rare. Field observations also confirm that deformation in the Green Creek Complex is systematically distributed, increasing vertically from the deepest exposures upward toward the profound unconformity (Armstrong, 1968a; Todd, 1973; Compton and other, 1977). Within the upper few hundred meters porphyroblastic textures and the effects of pronounced attenuation are conspicuous.

Elba Quartzite

The Elba Quartzite, named by Armstrong (1968a) for exposures at its type section in the south half of section 1, T. 14 S., R. 2 E., west of the village of Elba, Idaho, forms striking outcrops throughout the study area (plate 1). It is a key unit for structural and stratigraphic interpretations. Excellent exposures occur in Conner and Cottonwood Creeks, on the summit and north slope of Mount Independence, and around the perimeter of Moulton dome, all in the Albion Range. Elba Quartzite also caps Dennis Hill in the Dove Creek Mountains as well as the crest

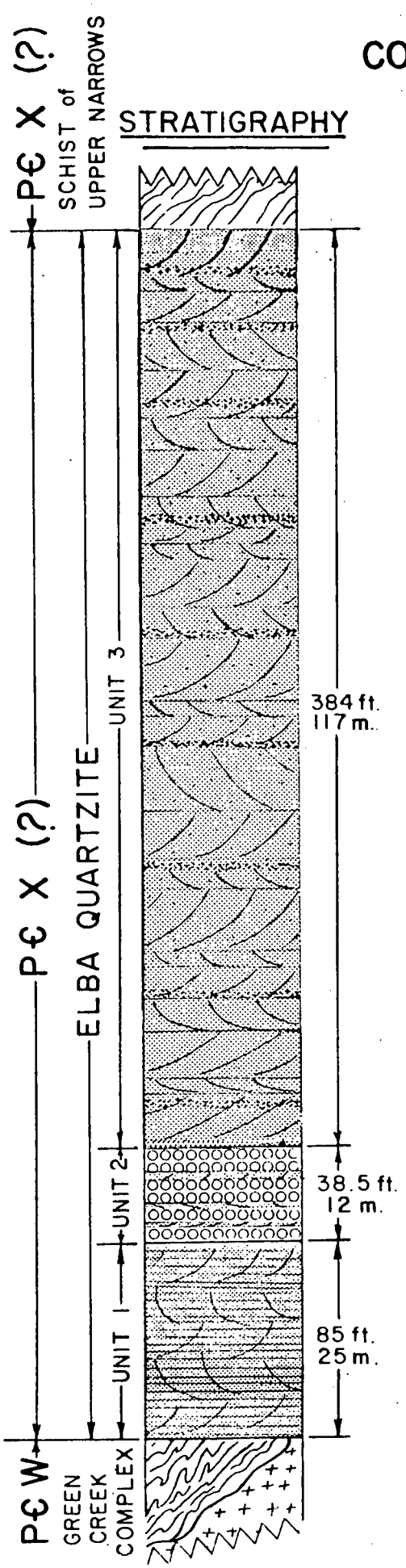
and northeast flank of the central Grouse Creek Mountains. The most spectacular outcrops occur in the canyons along the south flank of the Raft River Range where access is limited by private land ownership, with less spectacular but still prominent exposures in George Creek and Clear Creek Canyons and also along the entire north flank of the range (plate 1).

The Elba Quartzite consists of three widely recognized and extensive lithofacies in the Raft River area (fig. 6). A fourth, and more local, lithofacies is present and well exposed along the crest and north flank of the Raft River Range (Compton, 1975). Listed in ascending stratigraphic order the four lithofacies are (1) white quartzite, (2) white quartzite pebble conglomerate, (3) tan-weathering feldspathic quartzite, and (4) fine-grained, mica-feldspar-quartz schists (locally restricted to the Raft River Range).

The extensive basal lithofacies of the Elba Quartzite consist predominantly of white, vitreous, dense, well-sorted, thinly-bedded, cross-bedded, sparsely micaeous quartzite. It is generally less than 30 meters (100 feet) thick (fig. 6; Armstrong, 1968a; Compton, 1975). The lower contact is sharp and unconformable. The upper contact is sharp and occurs at the base of the overlying quartzite pebble conglomerate. The lower quartzite member is lithologically and sedimentologically quite similar to the Yost Quartzite.

Several less significant but distinctive lithologies occur in the basal member of the Elba Quartzite. A pebble to cobble conglomerate with predominantly white but occasionally green quartzite and rare adamellite clasts occurs locally in depressions of the regional unconformity. Clasts are flattened and elongated in a plane parallel to bedding, and long axes parallel D2 fold axes. Locally developed or Archean adamellite

ELBA SECTION LOCATED IN COTTONWOOD CANYON ALBION RANGE >155 m. (508 ft.)



DESCRIPTION

Quartzite: (Unit 3) — Fresh surfaces are white to gray: weathers tan to reddish brown. Because of rod-shaped dolomite bodies; thin to thick-bedded with cross stratification throughout; fine to coarse-grained with grit common; moderately sorted; slightly micaceous; 5-15% microcline feldspar; contains 3-5% opaque heavy minerals; gradation contact with overlying schist of upper narrows; distinctive features are the iron-staining and tendency to form cliffs.

Conglomerate: (Unit 2) — White to light gray quartzite pebble conglomerate; moderately sorted with thin to thick bedding; locally fuchsitic; contains interbedded white to light gray, crossbedded, moderately sorted medium to coarse-grained, gritty quartzite; quartzite is micaceous and feldspathic. This unit contains several percent opaque heavy minerals and is more radioactive than the enclosing quartzite units with readings of 60-160 cps. (GR-101A counter); color, composition, and texture distinctive; contact with underlying quartzite sharp and conformable.

Quartzite: (Unit 1) — White to greenish-gray, dense, vitreous, predominantly thin-bedded quartzite; contains about 1% opaque heavy minerals; unit is crossbedded; small-scale folding, bedding plane shearing, and tectonic thinning become more common as the underlying Green Creek Complex contact is approached; actual contact is commonly covered; originally probably very fine to fine-grained, moderate to well-sorted sand; this unit might be confused with parts of Yost Quartzite, distinctive features include stratigraphic position, lithology, and bedding.

Figure 6.

below the lowest Elba Quartzite or conglomerate layer is a white mica-rich schist which is a metamorphosed paleoregolith (Armstrong, 1968a; Compton, 1975). Two dark-brown weathering, gray, hematite-rich quartzite beds, each approximately a meter thick, are present in the lower part of the basal quartzite member throughout the Raft River Mountains. They are probably variants of the hematite-rich schists found on the southeast flank of the range (Compton, 1975).

The extensive middle member of the Elba Quartzite is a distinctive, thin, white, dense, vitreous, quartzite pebble conglomerate with interbeds of white to light gray, silty to pebbly, cross-bedded quartzite (fig. 6). Pebble size and shape are relatively uniform, but severe deformation has obscured their original forms. The matrix typically comprises less than 15 percent of the conglomerate and consists of micaceous, and locally fuchsitic, quartzite. Thickness is highly variable throughout the study area, ranging from a few meters to 12 meters (38.5 feet; fig. 6). Contacts with overlying and underlying members are conformable and gradational. The conglomerate facies was recognized everywhere except in the Grouse Creek Mountains. This is not surprising because Compton (1975) noted that most lithofacies variations in the Elba Quartzite disappear westward in the direction of thickening.

The upper member of the Elba Quartzite accounts for more than half of the formation in the area (fig. 6). It consists predominantly of tan-weathering, light-to dark-gray, medium-to thick-bedded, gritty to pebbly, feldspathic to locally arkosic (microcline), moderately sorted, cross-bedded quartzite. Cross-bedding ranges in scale from a few centimeters to several meters. The largest is present in exposures above Bull Lake in the central Raft River Mountains. White, reddish-

brown, greenish-gray, green, and bluish-green quartzites were also seen. The green and bluish-green varieties are fuchsitic, and are quarried locally for sale as a decorative building stone. The tan pigment is residual to leached dolomite grains which have been tectonically flattened and lineated (Compton, 1972). Mica is also a common constituent in small amounts. Thickness of the upper quartzite ranges six to 117 meters (20 to 384 feet; fig. 6; Armstrong, 1968a, Compton, 1972, 1975). Contact relations with underlying and overlying units are conformable and gradational.

Along the crest and north flank of the Raft River Mountains a fourth lithofacies of the Elba Quartzite is locally present and well exposed. Compton (1975) recognized, mapped, and informally named this member the Elba schist. It is a dark-brown weathering, fine-grained, mica-feldspar-quartz schist. It was originally a thinly laminated siltstone that is now 183 meters (600 feet) thick in the most complete exposures. It thins southward and wedges out along a line that crosses the higher part of the range somewhat obliquely, with a bearing of N. 75° W (Compton, 1975). This schist member was sampled but not measured or studied in any detail.

Sedimentary structures in the Elba Quartzite, although few in type, are generally well preserved. Cross-bedding, usually small-scale, is both conspicuous and ubiquitous in quartzite. It is accentuated by alternating cross-laminae, rich in quartz and opaque heavy minerals. Relatively even, parallel bedding surfaces prevail. Graded bedding was observed in some conglomerate beds, as was a very weak clast imbrication in a few three-dimensional outcrops. By and large, however, ductile deformation has obliterated primary sedimentary fabrics in the conglomerates

and superimposed a strong D2 metamorphic fabric. Features interpretable as channel structures and clay galls are entirely lacking.

Variations in thickness of the Elba Quartzite are predictable and pronounced. Compton (1975) noted, and the writer concurs, that thickening and lithologic homogeneity generally increase from east to west in the study area. Superimposed on this trend however, are loci of maximum thinning which coincide with crests of anticlinal ranges, apexes of gneiss domes, and limbs of recumbent folds. Thus, thickness ranges from as little as three meters (10 feet; Armstrong, 1968a) to as much as 457 meters (1500 feet; Compton, 1972). Most of the variation in thickness stems from ductile flow during metamorphism, attenuation accompanying extensive low-angle faulting, and assimilation attending remobilization of Archean adamellite or intrusion of Tertiary plutons. Some, however, is undoubtedly due to variations in original depositional environments and sedimentary processes.

The deformation intensity and metamorphic grade in the Elba Quartzite are similar to that of the underlying Green Creek Complex, and are lowest in intensity and grade in the eastern part of the Raft River Range and highest toward the west in the Grouse Creek Mountains (Compton and others, 1977). With few exceptions, notably the recumbent folds along the south flank of the Raft River Range, the Elba Quartzite is right-side up, as evidenced by cross-bedding, and is moderately deformed, except for the ductile flow and attenuation reflected in small-scale metamorphic folds and flattened and stretched clasts in conglomerates.

The accessory mineral suite of the Elba Quartzite is not well

studied and therefore, not well known. Todd (1973) noted sphene, and Compton (1972, 1975) reported hematite, ilmenite, zircon, and tourmaline. In addition, Bill Gallant (oral communication, 11/13/79) found monazite, rutile, apatite, and possibly uranothorite (?), a rare earth oxide, in samples of the Elba from the Almo Creek area in the Albion Range. Perhaps the mineral in question is allanite since it is one of the more abundant accessory minerals in the Archean adamellite and might logically be expected to occur in the Elba Quartzite (Todd, 1973).

Euhedual pyrite is locally abundant. It is conspicuously associated with intense near-vertical fracturing of Elba outcrops above Bull Lake, in the vicinity of Century Hollow, and in the area of Johnson and Charleston Creeks in the central, southwestern, Raft River Mountains, respectively. The pyrite is definitely not detrital but rather is epigenetic and probably related to a hydrothermal system of Oligocene, or younger, age. Syngenetic pyrite is notably lacking in all quartzite and conglomerate units.

Stratigraphy, sedimentary structures, and textural and compositional attributes of the Elba Quartzite suggest that deposition was predominantly in a shallow, moderate to high energy, nearshore, marine environment. This interpretation is based solely on the areal extent of various lithofacies, uniformity of lithofacies, bedding style, generally small-scale cross-bedding and the conspicuous absence of sedimentary structures diagnostic of fluvial processes. The quartzite pebble conglomerate member reflects renewed uplift and erosion in the source area and temporary regression of the strandline with development of a fluvial-marine deltaic facies. Otherwise, the overall fining upward texture, and the dolomite content of the upper quartzite member, suggest a normal transgressive depositional sequence. Transgression occurred over Archean crystalline and metasedimentary

terrane having paleorelief measurable in tens of meters (Armstrong, 1968a).

It was not possible to make quantitative paleocurrent measurements on cross-stratification in the quartzites, or to determine clast imbrication in the conglomerates, for a variety of reasons, most notable being extreme deformation of primary sedimentary fabrics, generally poor expression of cross-bedding surfaces, very limited two-dimensional exposures, and finally inclement weather. However, qualitiative field observations throughout the study area suggest that sediment transport was dominantly in a westerly direction.

Throughout the study area the Elba Quartzite is unconformably underlain by the Green Creek Complex and conformably overlain by the Upper Narrows Schist (plate 1). Gradational contact with the Upper Narrows Schist occurs over a stratigraphic interval of a few meters to tens of meters (Compton, 1972). For details concerning the schist of the Upper Narrows, the reader is referred to the publications of Compton (1972, 1975), Compton and others (1977), and Miller (1978).

Yost Quartzite

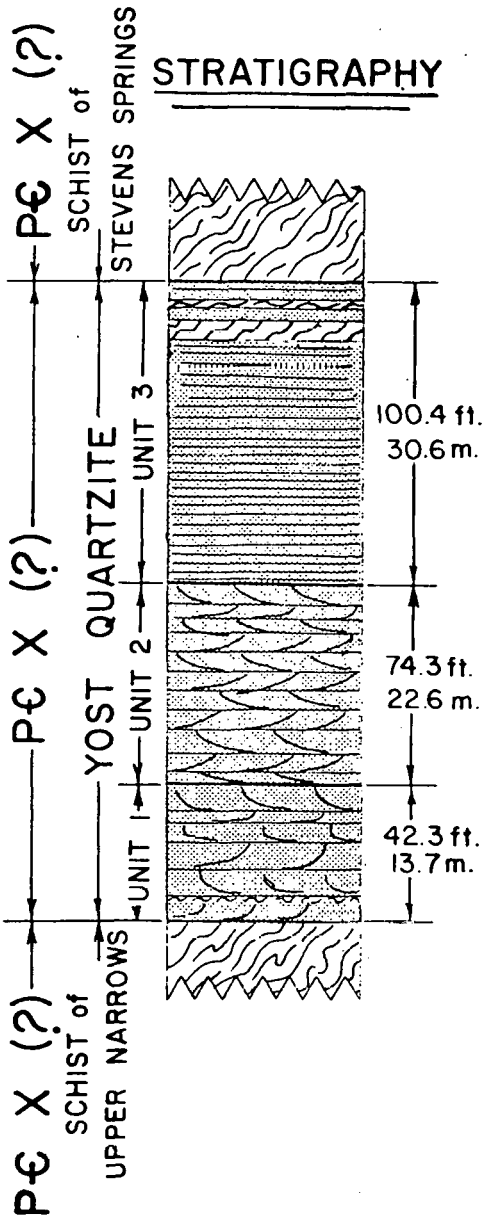
The Yost Quartzite was mapped and informally named by Compton (1972) for a 122-meter thick (200 to 400 feet) interval of white to greenish-gray, thinly-bedded quartzite south of the village of Yost in the northwestern part of the Raft River Mountains (plate 1). The Yost Quartzite is relatively widely distributed and is typically associated with the oldest low-angle fault and allochthonous

sheet. Accordingly, complete sections are rare, and outcrops are more sporadic and commonly less prominent than some of the other quartzites. The best exposures occur in the Left and Right Hand Forks of Johnson Creek south of Yost, in the vicinity of the Upper Narrows in the Raft River, on the west slope of Cache Peak, and on the south slopes of the east-west ridge south of Connors Creek on Big Bertha dome. It was not observed anywhere in the Grouse Creek Mountains.

The Yost Quartzite is considerably more homogeneous than the Elba Quartzite. It consists predominantly of white, vitreous, dense, thin-to medium-bedded, micaceous, parrallel-laminated and cross-laminated quartzite (fig. 7). There is little basis for subdivision of the Yost into members, although the upper half is predominantly a sparsely micaceous, thinly bedded, parallel-laminated quartzite, whereas the lower half is a somewhat more micaceous, medium-bedded, cross-laminated quartzite. Compton (1972) observed some feldspar grains and quartz pebbles in thicker beds along Johnson Creek, but neither of these was noted by the writer in the measured section in the Right Hand Fork of Johnson Creek (fig. 7). Greenish-gray and green, fuchsitic quartzite, magnetite rich quartzite, and hematitic schists comprise subordinate lithologies locally, notably in the vicinity of the Upper Narrows of the Raft River (Compton, 1972).

Two types of primary sedimentary structures are present in the Yost Quartzite. Both are well preserved and conspicuous in outcrop. Even, parallel, primary lamination is well developed in the upper half

YOST SECTION LOCATED IN JOHNSON CREEK WESTERN RAFT RIVER MOUNTAINS >66m (217 ft.)



STRATIGRAPHY

DESCRIPTION

Quartzite: (Unit 3)	White, dense, vitreous, very thin-bedded to laminated, slightly micaceous quartzite, with a few schist interbeds near the top; upper contact is gradational with the overlying schist but locally brecciated due to bedding plane shearing; Pyrite of presumed hydrothermal origin has weathered to iron-oxides along bedding planes and fracture surfaces; originally fine to very fine-grained, well sorted sand.
Quartzite: (Unit 2)	White, dense, vitreous, thin to medium-bedded, slightly micaceous quartzite; cross-bedded; few percent opaque heavy minerals present; conspicuous bedding plane shearing and tectonic thinning; distinctive hackly cross-fracture prominent; quartzite as above.
Quartzite: (Unit 1)	White, dense, vitreous, thin to medium bedded, cross-stratified quartzite; may be slightly more micaceous then overlying quartzites; schist interbeds similar to underlying schist present near the lower contact; contact conformable and gradational; bedding plane shearing and tectonic thinning conspicuous.

Figure 7.

of the unit, where it is accentuated by alternating light and dark mineral laminae, a millimeter or so thick. In the lower half of the Yost, cross-lamination is conspicuous and similarly accentuated. The combination of thin, even, parallel beds and micaceous bedding surfaces imparts a pronounced flaggy bedding to the Yost Quartzites at a number of localities. Like the Elba, it is widely quarried and sold as ornamental building stone.

Low-angle faulting causes variable thicknesses in the Quartzite of Yost. Prior to extensive low-angle faulting, the unit was probably much more widely distributed and thicker. Compton (1972) reported a thickness of 122 meters (400 feet) south of Yost, 61 meters (200 feet) to the northwest, and pinchout to the southwest. A complete, but attenuated, section occurs in the Right Hand Fork of Johnson Creek south of Yost where thicknesses of slightly more than 66 meters (217 feet) are present (fig. 7).

The accessory mineral suite of the Yost Quartzite is not well known but compositional data suggest it is similar to Elba Quartzite. Unidentified opaque heavy minerals comprise, on the average, a few percent of the quartzite. Compton (1972) reported magnetite. Euhedral pyrite is present in the measured section and weathers to produce reddish and yellow-brown outcrops which contrast strikingly with the generally white Yost Quartzite. The pyrite is epigenetic, as is evidenced by an intimate association with late near-vertical fracturing and euhedual crystals of variable size. Assocation with brittle deformation structures suggests a relatively young age and a hydrothermal origin.

Contact relationships between the Yost Quartzite and the underlying

Schist of the Upper Narrows and the overlying Schist of Steven Springs are conformable and gradational (plate 1). Slippage and shearing in proximity to contacts are noticeable in good exposures, but beds above and below remain generally parallel. One or two beds of schist are interbedded in the top and bottom few meters of the Yost Quartzite. These are identical in all respects to those of overlying and underlying units.

Considerations of stratigraphy, sedimentary structures, and composition suggest deposition of Yost sands in intermediate depth, low to moderate energy, offshore, marine environment. In the context of the entire Precambrian X (?) succession, the Yost may reflect a temporary regression of the strandline and renewed uplift and erosion in the source area. Provenance consisted of a terrane lithologically similar to the Green Creek Complex.

Quantitative measurements of paleocurrents and determination of sediment transport direction were not possible because of generally poor exposures, very limited two-dimensional outcrops, typically small-scale cross-laminations, and difficulty in distinguishing between uncommon, large-scale cross-bedding surfaces and extensively developed low-angle surfaces of probable tectonic origin. Because the Elba-Upper Narrows-Yost-Steven Springs subgroup forms a genetic depositional sequence, paleocurrents and sediment transport directions probably changed little between Elba and Yost times.

URANIUM OCCURRENCES

There is scarcely a place in the western United States where a prospector has not searched for uranium with his geiger or scintillation counter. During the 1940's geologists with the Atomic Energy Commission and the U.S.G.S. conducted extensive investigations of mines, waste dumps, and prospects throughout the United States in search of uranium mineralization. As a result of this massive and highly successful search for uranium during the 1950's, a vast amount of basic information concerning the nature, distribution, and occurrence of radioactivity and uranium in the United States was acquired in the form of Preliminary Reconnaissance Reports (PRR's) by the Atomic Energy Commission. Review of the PRR's for a non-producing area is typically the starting point for assessment of its uranium potential.

The PRR's for Box Elder County, Utah and Cassia County, Idaho contain very little useful information. Only three reported uranium occurrences in Box Elder County are located within the study area. Two of these occurrences, reported in PRR's #5056 and #5061, are located in the Century Hollow (Park Valley) mining district in the southwestern Raft River Mountains. An occurrence reported in PRR #5055 is located at the head of Rosebud Creek in the southern part of the central Grouse Creek Mountains. No abnormal radioactivity or uranium minerals were noted at the sites reported in PRR's #5055 and #5066. The occurrence described in PRR #5061, located in T. 13 N., R. 14 W., had been reported to have radiation as high as 10 times background locally, in association with sparse pyromorphite (?), the latter having formed by oxidation of galena and pyrite in a massive white quartz vein.

sparse gold silver, lead, zinc, and copper mineralization is associated with the quartz veins in the Century Hollow area, but the district has been inactive since the early 1930's (Compton, 1975). All workings have now caved. In checking this general area, no significant anomalous radioactivity was detected in quartz veins, Archean adamellite or schist, or Elba Quartzite. However, subanomalous waters and anomalous stream sediment and rock samples were obtained from this area (figs. A-3, B-3, B-4, C-4 , and C-5). Moreover, a recent airborne radiation survey detected anomalous radioactivity in this area (plate 4). These results indicate additional field work is justified in the Century Hollow area.

Only four occurrences are reported in Cassia County, Idaho. Three were done within the study area, and two of the three reported anomalous radioactivity, but no uranium minerals. In all three instances, the locations lacked sufficient site descriptions which would have permitted field checking of the site. PRR #2500 reported radiation up to five times background in mine adits, but no interpretation or evaluation was provided. A single grab sample from a prospect pit yielded an equivalent uranium content of 0.036 percent. Thus, the anomalous radioactivity may stem from sparse uranium mineralization or radon build up in the adit due to poor air circulation. The associated ore deposits were described as mesothermal veins and replacements in quartzite, schist, and marble. Ore was mined for lead, silver, gold, copper, zinc, molydbenum, cobalt, and nickel. This metal suite is noteworthy in that it is reminiscent of that associated with classical veins and some Proterozoic unconformity-type uranium deposits (McMillan, 1978). The occurrence reported in PRR #2500 was not located in the field, but its reported location coincides with extensive exposures of allochthonous Precambrian Z (?) and Paleozoic

rocks in T. 12 S., R. 24 E. PRR #2501 located somewhere in T. 12 S., R. 25 E., reported anomalous radiation up to three times background in association with prospects and dumps developed in mesothermal veins in a porphyritic granite. The ores were mined for lead, silver, gold, and copper. No follow-up work was recommended for PRR #2501.

The geology described in PRR's #2500 and #2501 is reminiscent of that in the Ward mining district which is located in Connor Creek Canyon. No really anomalous radiation was noted in this area, but anomalous water, stream sediment, and rock samples were obtained from the Ward mining district (figs. A-3, B-3, B-4, C- 4 , and C- 5). Metamorphic segregations in Archean schist in Conner Creek contain samarskite, according to Bill Gallant (oral communication, 11/13/79). These occurrences are small and erratic and have no economic potential. Past mining activities, although small-scale, were numerous and thorough in the Ward district. It is quite unlikely that significant uranium mineralization or highly anomalous radioactivity would have been missed or gone unreported. Thus, no follow-up work is recommended for this area despite the geochemical anomalies.

No anomalous radiation or uranium minerals were reported in PRR #2503, which is located somewhere in T. 15 S., R. 24 E., W.J. Maybe of the U.S.G.S., who studied shale beds in the area, was quoted as saying that the highest equivalent U_3O_8 content in his study area was 0.35 percent. Geochemical and airborne radiation anomalies occur in this general area,

known as City of Rocks, and uranium minerals in a pegmatite and a placer are also known (Cook, 1955, 1957). Bill Gallant (oral communication, 11/13/79) noted garnet, plagioclose, magnetite, and samarskite in a pegmatite located in section 36, T. 15 S., R. 23 E. This locality also coincides with that of an airborne radiation anomaly (plate 4). The City of Rocks area has been thoroughly prospected and sampled. Notwithstanding the presence of geochemical anomalies, uranium minerals in pegmatite and placers, and an airborne radiation anomaly, no additional follow-up is recommended for this area.

The known occurrences of uranium within, or in proximity to, the study area are few in number and differ substantially from the types of deposits sought. Cook (1955, 1957), Mapel and Hail (1959), Armstrong (1964), and Keys and Sullivan (1979) described these occurrences. Of these only the City of Rocks pegmatite and placer occurrences fall strictly within the boundaries of the study area. The Goose Creek Basin and Raft River geothermal occurrences are included only to show the variety and types that might be expected within, and in proxmity to, the study area.

Cook (1955, 1957) mentioned that uranium minerals, both in pegmatites and in placers derived therefrom, occur in the City of Rocks area of Cassia County. No other information is provided. Bill Gallant (oral communication, 11/13/79) informed the writer that small occurrences of garnet, plagioclase, magnetite, and samarskite were observed in pegmatites north of the three-way intersection in the City of Rocks area (section 36, T. 15 S., R. 23 E.) and that late stage aplite dikes and pegmatite carry as much as 40 ppm uranium in the Castle Rocks area, located a few miles

to the north. He also obtained a few chemical values as high as 500 ppm uranium for small quartz-feldspar metamorphic segregations in schist of the Green Creek Complex in the Conner Creek Area on Big Bertha dome, located about 15 miles to the northeast. None of these uranium occurrences has any commerical potential, and insofar as could be determined, no uranium has ever been produced within the study area.

Goose Creek Basin includes an area of several hundred square miles near the common borders of Utah, Idaho, and Nevada. The eastern margin of the basin coincides with the western boundary of the study area (plate 1). Fluvial, paludal, and lacustrine sediments, and interbedded volcanic ash and rhyolitic ash flow tuffs form an extensive stratigraphic succession of late Miocene and Pliocene age. Except for the coarsest-textured lithologies, most sediments and volcanics are slightly radioactive. According to Mapel and Hail (1959), two samples of rhyolite contained 60 to 70 ppm uranium, and samples of volcanic ash contained up to 10 ppm uranium.

Lignite and carbonaceous shale exhibit wide variations in uranium contents, both laterally and vertically, ranging from 10 to 1200 ppm (Mapel and Hail, 1959).

Potential low-grade resources in Goose Creek Basin total about 100 short tons of uranium in lignite and carbonaceous shale beds at least one foot thick containing at least 0.010 percent uranium (Mapel and Hail, 1959). The uranium is believed to have been derived from laterally and vertically adjacent volcanic flows and ash, leached and transported by alkaline groundwater, and precipitated by adsorption and reduction within the lignite and carbonaceous shale beds on the limbs of

a gentle syncline during descent of the groundwater (Mapel and Hail, 1959).

Not much is known about the occurrence and distribution of uranium in the nearby Raft River geothermal system. Keys and Sullivan (1979) noted some interesting relationships between zones of hot water entry and hydrothermal alteration and radioisotope concentrations of equivalent uranium, thorium, and potassium. Limited data suggest uranium enrichment in hydrothermally altered zones and uranium mobilization in zones of hot water entry (Keys and Sullivan, 1979). Also noteworthy are the observations that Precambrian W adamellite exhibits considerable variation in radiation response, that hydrothermal alteration (chloritization) is extensive in the deeper part of the Raft River reservoir where Precambrian quartzite and schist are present, and that anomalous concentrations of thorium (up to 140 ppm) and equivalent uranium (up to 100 ppm) characterize these altered Precambrian rocks (Keys and Sullivan, 1979). Thus, although the data are sparse, they hint that areas of hydrothermal alteration may be prospective targets for uranium mineralization.

RADIOACTIVITY

Ground Radiometrics

Numerous radiation measurements were obtained throughout the Raft River area. Most measurement stations coincide with, and are tied to, sampling sites from which water, stream sediment, and rock samples were collected. Radioactivity was measured with either a scintillation counter (GR-101A) or a four-channel gamma ray spectrometer (GAD-6) with digital readout. The GAD-6 was checked and calibrated daily. Spectrometer readings were converted from counts per second (cps) to counts per minute (cpm) to be compatible with the NURE-HSSR data base. The formula factors used to calculate equivalent potassium (K), uranium (U), and thorium (Th) contents from counts per second were those obtained from BFEC when the instruments were checked and calibrated at the Grand Junction instrument calibration facilities.

Insofar as possible, radiation measurements were taken with the instruments resting on nearly flat ground or rock surfaces well removed from the effects of vertical relief. One scintillation counter broke down during the middle of the field effort, and the spectrometer, being much more susceptible to malfunctions during field operations, experienced considerable downtime. This is the reason for the somewhat less than desired coverage, although not all of the spectrometer radiation data are included in appendix C. More data are presented in the percentile plots of equivalent KUT comprising figures C-8, C-9, and C-10. A partial statistical summary of the spectrometer data is included in table C-I.

The areal distribution of radioactivity stations is shown on plate 4. Numerous scintillation measurements were obtained, but they are not included in appendix C. However, they reflect exactly the relationships evidenced by the spectrometer radiation data. The observed radiation response and relative radioactivity of the various stratigraphic units are depicted graphically in figures C-12 through C-15. The geologic codes are explained in table IV and serve to identify lithologic as well as stratigraphic units. The use of multiple geologic codes for the same lithostratigraphic units is due to the fact that previous geologic mapping and published reports in the Raft River area were done by four different geologists, and the areal lithologic and stratigraphic correlations were not finalized unitl after the analytical data were studied.

The radiation data graphically presented in figures C-12 through C-15 depict exactly the relationships noted for the major lithostratigraphic units within the first few weeks of sampling and field observations. In general, the Green Creek Complex exhibits the highest radioactivity, as well as the highest equivalent radioelement contents of the measured rocks (figs. C-8 through C-10 and C-12 through C-15).

The most uraniferous and radioactive lithologies in the Green Creek Complex include adamellite, or its metamorphosed equivalent, adamellite gneiss, and trondhjemite, pegmatite, and silicic schist. Mafic schist and amphibolite are the least uraniferous and exhibit the lowest radioactivity. It is also noteworthy that the adamellite gneiss in the Grouse Creek and Albion Mountains corresponds to the highest structural level and the highest metamorphic grade exposures of the Green Creek Complex (Armstrong,

GEOLOGIC UNIT CODE	FORMATION NAME	LITHOLOGY	MODIFIED AFTER: ARMSTRONG (1968)	COMPTON (1972-75)	MILLER (1978)	DOELLING (1979)	TODD (1973)	IDAHO BUREAU OF MINES & GEOLOGY (1979)	SAMPLE TYPE: ROCK	SEDIMENT	WATER
UKQD	Unknown	Quartz Vein		X					X		
QAGT	Unknown	Water Lain Tuff				X			X		
QAL	Alluvium, Colluvium		X		X	X		X		X	X
QU	Alluvium, Colluvium			X						X	X
QAS	Alluvium, Colluvium			X				X		X	X
QU	Undifferentiated		X	X	X	X	X	X		X	X
QF	Alluvium							X		X	X
QAG	Alluvium					X				X	X
TSL	Salt Lake Formation					X				X	X
TAP	Almo Pluton	Granitic	X					X	X	X	X
TV	Ash Flow Tuffs							X		X	X
TVG	Tuffs		X					X		X	X
TS	Sediments			X							X
PPO	Permian Penn.Undiff.							X		X	X
PO	Oquirrh Formation		X	X	X				X	X	X
OP	Pogonip Group			X	X		X		X	X	X
ЄMP	Schist of Mahogany Peaks			X		X	X	X	X	X	X
ЄCB	Quartzite of Clarks Basin			X	X	X	X	X		X	X
ЄCBQ	Quartzite of Clarks Basin	Quartzite		X	X	X	X	X	X		
ZHSQ	Harrison Summit Quartzite	Quartzite			X				X		
ZHS	Harrison Summit Quartzite		X		X					X	X
ЄSS	Schist of Stevens Spring							X		X	
PЄSS	Schist of Stevens Spring	Schist		X			X		X	X	X
PЄY	Quartzite of Yost			X		X				X	X
PЄYQ	Quartzite of Yost	Quartzite		X		X			X		
PЄYS	Quartzite of Yost	Schist		X		X			X		
XY	Quartzite of Yost				X					X	X
ЄY	Quartzite of Yost							X		X	
ЄYQ	Quartzite of Yost	Quartzite						X	X		
ЄNS	Schist of the Upper Narrows							X	X	X	X
PЄUN	Schist of the Upper Narrows	Schist		X					X	X	X
XUNS	Schist of the Upper Narrows	Schist				X			X		
XUN	Schist of the Upper Narrows					X				X	X
PЄE	Elba Quartzite		X	X		X	X	X		X	X
PЄEQ	Elba Quartzite	Quartzite	X	X		X	X	X	X		
PЄLS	Elba Schist	Schist		X					X		
PЄEC	Elba Quartzite	Pebble Conglomerate	X	X				X	X		
XE	Elba Quartzite				X					X	X
XEQZ	Elba Quartzite	Quartzite			X				X		
XEPC	Elba Quartzite	Pebble Conglomerate			X				X		
PЄOS	Older Schist	Schist		X					X	X	X
PЄOT	Older Schist & Trondhjemite	Composite Sample		X					X		
PЄTR	Metamorphosed Trondhjemite	Trondhjemite		X					X	X	X
PЄMI	Mafic Igneous Rocks	Undetermined		X					X	X	X
PЄA	Adamellites			X		X	X			X	X
PЄAD	Adamellites	Adamellite		X		X	X		X		
PЄAG	Adamellites	Gneiss		X		X	X		X		
PЄAS	Adamellites	Schist		X		X	X		X		
WGGN	Green Creek Complex	Gneiss	X		X			X	X		
WGAD	Green Creek Complex	Adamellites	X		X			X	X		
WGSH	Green Creek Complex	Schist	X		X			X	X		
WGGS	Green Creek Complex	Gneiss & Schist	X		X			X	X		
WG	Green Creek Complex		X		X			X		X	X
		UNITS OF UNKNOWN AGE AND CORRELATION									
MM	Quartzite							X		X	X
DC	Quartzite of Daley Creek							X		X	X
GN	Injection Complex of Middle Mountain							X		X	X
CD	Dolomite of Cassia County							X		X	X

Table IV

EXPLANATION OF GEOLOGIC UNIT CODES USED IN GEOCHEMICAL SAMPLING

1968a; Compton and others, 1977).

Relative to igneous and metamorphic rocks in general, lithologies in the Green Creek Complex are neither abnormally radioactive nor anomalously uraniferous. This is reflected in the logprobability, logfrequency, and percentile plots of radiometric-equivalent and chemical uranium, thorium, and potassium contents for these rocks (figs. C-2, C-3, C-6, and C-8 through C-15). They contain, on the average, only clarke concentrations of uranium now, although completely unweathered or premetamorphic adamellite may have contained nearly twice as much uranium. The effects of regional metamorphism and Cenozoic plutonism on the uranium contents of rocks in the Green Creek Complex are unknown, but the presence of soluble uranium is indicated because of the statistically significant and high positive correlation coefficients between soluble (fluorometric) and total uranium contents in stream sediment and rock samples (tables B-II and C-VIII).

Precambrian X (?) schists and conglomerates are the next most radioactive rocks in the study area. Although data for the conglomerates are not included, examination of the chemical, radiation, and radiometric-equivalent data indicates that these lithologies compare quite favorably to rocks in the Green Creek Complex (figs. C-2, C-3, C-6, and C-8 through C-15). Precambrian X (?) schists and conglomerates exhibit higher radioactivity than quartzites. The response is relatively uniform (100 to 200 cps) throughout the study area and except in the presence of abnormal heavy mineral concentrations, rarely exceeds 200 cps on a GR-101A scintillation counter. This is about the same range and maximum as observed for rocks in the Green Creek Complex, although high count was encountered more frequently in the latter unit.

Irrespective of age, quartzites are neither very radioactive nor very uraniferous (tables C-II and C-III and figs. C-2, C-3, C-6, and C-8 through C-15). Proof of this is further reflected in the coincidence of two large Precambrian X (?) and Z (?) quartzite exposures in the northern Albion Range and two prominent geochemical lows in uranium concentrations in waters (fig. A-3). Quartzite with anomalous radioactivity of three to four times background was noted locally in the Elba outcrops above Bull Lake Cirque in the central Raft River Mountains. The anomalous radioactivity is believed to stem from oxidation of weak, but pervasive, epigenetic pyrite mineralization and accompanying absorption of sparse uranyl sulfate in ferric hydroxides precipitated in ubiquitous fractures as waters evaporate at the outcrop.

Paleozoic carbonate rocks were not studied in any detail during this study because they are typically poor sources of, and unlikely hosts for, economic uranium mineralization. Moreover, any mineralization likely to occur in carbonates falls outside the scope and objectives of this study. Nonetheless, a few comments on their radioactivity is appropriate at this point. Some radiation measurements were obtained but they are not included in Appendix C. Paleozoic carbonates, like quartzites, typically display low count, usually less than 75 cps on a GR-101A scintillation counter. They also contain low uranium values. This is substantiated by the low uranium contents of water collected from, or very near, extensive carbonate exposures. Only two exceptions occur in the study area, and both can be explained by the oxidation of sulfides and extensive dissolution of Paleozoic carbonates by acid sulfate water.

The study of tuffaceous, fluvial-lacustrine, basin-fill sediments likewise falls outside the scope and objectives of this investigation, but a few comments concerning their radioactivity are deemed worthwhile. Exposures of tuffaceous sediments generally coincide with or are outside of the boundaries of the study area. These sediments exhibit a wide range of radioactivity. Fine-grained lithologies typically count the highest and coarse-grained lithologies the lowest. A typical range is 50 to 150 cps on a GR-101A scintillation counter. Relative to other rocks in the study area, this is higher than quartzites and Paleozoic carbonates and lower than adamellites, pegmatite, trondhjemite, schist, or Elba conglomerate. While these sediments were not observed to be anomalously radioactive or mineralized, Mapel and Hail (1959) reported them to be such in Goose Creek Basin, which is located just west of the study area and southwest of Oakley, Idaho (plate 4).

Airborne Radiometrics

Recently flown and open-filed airborne radiometric surveys cover all of the Raft River area on a wide-spaced grid (Texas Instruments, 1979; Geodata International, 1979). Twenty-one airborne anomalies were detected and classified as preferred anomalies. These are shown on plate 4. The following remarks are intended to provide some evaluation of those preferred anomalies which warrant additional sampling and field checking in light of the findings of the present study. Some water, stream sediment, and rock sampling sites coincide with or occur in close proximity to some of the airborne anomalies (plates 2-4).

Airborne anomalies 1, 2, 5, 6, 7, 12, 16, and 21 correspond to areas underlain by either Precambrian Z (?), Paleozoic, or Tertiary sedimentary rocks. For the most part, these same areas coincide with sparse geochemical sampling coverage, because the bedrock geology was not related directly to the scope and purpose of the present investigation. Accordingly, very little information can be provided about the origin of anomalies 1, 2, 6, 7, 12, 16, and 21. Anomalies 1 and 2 correspond to allochthonous sheets of Paleozoic carbonates and Precambrian Z (?) quartzite, schist, and marble, respectively. Tuffaceous, fluvial-lacustrine, basin-fill sediments masked by a thin veneer of alluvium underlie airborne anomalies 6, 7, and 16 and probably also anomaly 21. While none of these airborne radiation anomalies are believed to be related to important uranium mineralization, this is purely speculation and follow-up is probably justified in the absence of reliable data.

Anomaly 3 is believed not to be related to uranium mineralization having economic potential but rather to be due to combined effects of altitude, topography, and Archean adamellite gneiss. It may be reinforced by uraniferous heavy mineral concentrations in nearby Elba conglomerates, but they are not definitely known to be present in this area, although Armstrong (1968a) reported Elba conglomerate not too far distant in the cirque northwest of Cache Peak. Nearby stream sediment anomalies are interpreted to reflect concentrations of resistate heavy minerals derived from erosion of the Green Creek Complex.

The origin of anomaly 4 is likewise unknown but is believed to be unrelated to uranium mineralization of any importance. It may represent an error in classification, inasmuch as the anomaly was assigned to the

Stevens Spring-Yost-Elba sequence in the airborne report (Texas Instruments, Inc., 1970). The platted location on plate 4 corresponds to outcrops of Upper Narrows schist (plate 1), which within the study area are known to contain small, scattered metamorphic segregations of quartz-feldspar, potassic-granite, and carbonate-bearing syenite. These may be quite radioactive very locally (400 to 500 cps), but from an economic viewpoint, the segregations are too small and widely scattered to be of any consequence as a commercial source of uranium. However, they may be the source of or contribute to the detected anomaly. Nearby subanomalous and anomalous stream sediment samples reflect resistate heavy mineral concentrations resulting from erosion of Precambrian W and X (?) rocks and Tertiary adamellite (plate 3).

Airborne anomaly 5 coincides, in general, with an Oligocene adamellite intrusion, the Almo pluton, and specifically, with a pegmatite uranium occurrence. According to Bill Gallant (oral communication, 11/13/79), garnet, plagioclase, magnetite, and samarskite occur in the pegmatite, located in section 36, T. 15 S., R. 23 E. Interestingly, hydrogeochemical anomaly 41 (plate 2) is located approximately two miles southeast in a small creek draining Archean and Oligocene adamellites and Precambrian X (?) quartzite and conglomerate (plates 1-2). Neither the airborne nor the stream water anomaly reflect uranium mineralization with economic potential. The stream water anomaly may be accentuated by and related to oxidation of weak epigenetic sulfide mineralization in the Elba Quartzite. The single stream sediment anomaly signifies an abnormal concentration of uranium

in heavy minerals disseminated in and weathered and eroded from pegmatite, aplite, adamellite, quartzite, and conglomerate. The City of Rocks area is believed to have been thoroughly explored by both early prospectors and the sampling crew. No follow up is recommended for either the airborne or geochemical anomalies.

The source of airborne anomaly 8 is likewise unknown but is speculated to be closely related to the origin of two uraniferous springs corresponding to the same location (plate 2, anomaly 40). The chemistry of the springs suggests that oxidation of pyrite and solution of bedrock by acid sulfate water probably account for the two hydrogeochemical anomalies. Whereas details of the local geology are unknown, they may be similar to those of known areas in the Raft River Mountains where Elba or Yost quartzites are weakly but pervasively mineralized with pyrite. Oxidation results in mobilization of uranium and other highly soluble elements which in turn may be adsorbed by, and precipitated with, insoluble ferric hydroxide to form a modestly radioactive gossan in the absence of significant uranium mineralization. These processes may contribute to the cause of both the airborne anomaly and the associated two point hydrogeochemical anomaly. Stream sediment coverage is excellent, but no anomalies exist (plate 2). As a precautionary measure, follow up sampling and additional field observations of geology are recommended, though the origin of airborne anomaly 8 is probably related to the combined effects of altitude, topography, contrasting radioactivities of quartzite and adamellite, and weakly uraniferous gossan.

Airborne anomaly 9 is assigned in the airborne report to the Precambrian Harrison Group (Geodata International, Inc., 1979). This is an obsolete stratigraphic term deriving from Anderson's (1931) early work in the Albion

Range. Armstrong (1968a) proved the unit to be composite, that is, including units of both Archean and Oligocene age. Geochemical sample coverage in this area is lacking, but the geologic, topographic and geographic settings of the airborne anomaly suggest two possible explanations, neither of which involves important uranium mineralization. Both explanations invoke the combined effects of altitude and topography, as shown on plate 4, and the presence of either Elba conglomerate or Upper Narrows schist. Since the position of the airborne anomaly apparently allows for either or both lithologies to be present (plate 1), the anomaly probably respresents the combined effects of altitude, topography, and lithology and bears no relation to significant uranium mineralization.

Airborne anomaly 10 was assigned to the Dove Creek Group in the original report (Geodata International, Inc., 1979). The platted position of the anomaly, however, straddles outcrops of Tertiary welded dacite tuff and schist of the Upper Narrows (plate 1). Moreover, this anomaly is also situated between two springs which discharge from the Upper Narrows schist (plate 2). The northern spring contains 7 ppb uranium and the southern spring,3.5 ppb (table A-V). Both are typified by anomalous sulfate and chloride contents, which suggest the spring waters owe their anomalous and subanomalous uranium values to abnormal salinity resulting from subsurface oxidation of disseminated pyrite and accompanying dissolution of schist by acid sulfate water. In light of these observations and interpretations, it is doubtful that the airborne anomaly relates to important uranium mineralization. If, however, other airborne anomalies not far distant are checked, this should be checked also, since access is excellent and follow-up would require little additonal time.

The origin of anomaly 11 is unknown. It was assigned to Tertiary tuffaceous sediments in the airborne report, but the plotted location on plate 4 corresponds to Archean adamellite gneiss and Precambrian X (?) rocks, which suggest a misclassification of radiation data. Moreover, the combined effects of altitude and topography may also be contributing factors, since anomaly 11 coincides with the crest of the mountain. Single point hydrogeochemical and stream sediment anomalies occur just south of the airborne anomaly (plate 2-3), but neither is interpreted to be related to significant uranium mineralization. The uranium content barely exceeds threshold, and the chloride is subanomalous, suggesting an origin due to the effects of bedrock solution and salinity. The stream sediment anomaly likely derives from resistate heavy minerals. No follow-up is recommended for either the airborne or geochemical anomalies.

Anomaly 12 was assigned to Quaternary alluvium, but a more likely source is a fault slice of either Mahogany Peak or Stevens Spring schist. Both are mapped in this area where extensive exposures of Clarks Basin Quartzite and these two schists alternate in several imbricate sheets (Compton, 1972). Quartzite possesses very low radiation response, but these schists typically count in the range of two to three times quartzite. Noteworthy are three hydrogeochemical anomalies about three miles to the southeast of the airborne anomaly (plate 2). All three are stream waters collected from low points in their respective drainage basins. One steam drains the entire area surrounding and including the airborne anomaly. All three waters contain uranium values at most 2 ppb in excess of threshold (4.33 ppb) and have anomalous chloride. These three uraniferous waters do not reflect important uranium mineralization but rather the combined

effects of chemical weathering and solution of bedrock, which result in barely anomalous uranium values downstream where the effects of salinity become more pronounced, as reflected in the associated chloride anomalies. Stream sediment anomalies are absent in this area (plate 3). No follow-up is warranted for either the airborne or hydrogeochemical anomalies.

Airborne anomalies 13, 14, 15, 18, 19, 21, and 22 share some common attributes which are believed to account for most, if not all, of the anomalous radioactivity. All are similar, in that platted locations (plate 4) coincide closely with contacts between lithologies exhibiting sharply contrasting radiation response. Without being specific for each anomaly, the contacts involve a combination of either Paleozoic carbonate, Yost Quartzite, or Elba Quartzite, all of which possess low radioactivity, and Archean adamellite or schist, or Precambrian X (?) schist or conglomerate, which all exhibit higher radioactivity (figs. C-12 through C-15). In addition, anomalies 13, 14, 17, 18, and 22 are situated in settings where terrain effects could contribute to, or accentuate, these radiation contrasts. They lie at high elevations on the crests of hills or mountain ridges, whereas 15 and 17 coincide with canyons (plate 4). Anomalies 14, 17, 18, and 22, therefore, probably originate from the combined effects of terrain and sharp contrasts in radioactivity between bedrock lithologies. While geochemical sample coverage in the immediate areas of these four airborne anomalies is either entirely lacking or sparse, none is believed to reflect significant uranium mineralization.

Airborne anomalies 13, 15, 19, 20, and 21 are similar in some respects to the previously discussed anomalies, but in all five instances the possibility exists that the anomalies relate to uranium mineralization, though of dubious importance. All of these anomalies coincide with, or

or occur in proximity to, known districts having generally weak base and precious metal sulfide mineralization. Sulfides occur in faults, quartz veins, and contact zones. Some districts have produced significant amounts of silver. Anomalous or subanomalous uranium contents characterize waters and stream sediments obtained from within or very near the airborne localities (plates 2-3). These areas are likewise underlain by the more uraniferous and radioactive Precambrian W and/or X (?) lithologies (plate 1). The preferred interpretation is that neither the airborne nor the geochemical anomalies indicate significant uranium mineralization.

HYDROLOGY

Available hydrologic reports deal almost exlusively with the basins adjacent to, and generally outside of the study area boundaries. This is to be expected since major water utilization, farming, and water recreation activities are restricted to the low relief areas.

Within the Raft River area, climate varies from semihumid in the high mountains to semiarid on the adjacent valley floors. Annual precipitation, mostly in the form of snow, ranges from 250 to 1016 mm (10 to 40 inches) in the basins and mountains, respectively. A number of the larger drainages are perennial and springs of small discharge are widely distributed in the mountains. Most of these springs are located along lithologic contacts. Thus, springs or seeps coincide with contacts between fractured Elba Quartzite and the Green Creek Complex and also between quartzite and schist juxtaposed along low-angle faults.

Rocks in the mountains of the study area transmit and store insignificant quantities of water as compared with adjacent basins. This is because virtually all of the primary porosity and permeability have been destroyed during deformation and metamorphism. Thus, only small quantities of water are stored and transmitted via secondary porosity any permeability avenues, such as faults, fractures, joints, and solution cavities.

The mountains serve as temporary storage areas for large amounts of precipitation in the form of snow. Thus, sampling in the study area was necessarily limited to springs, seeps, and perennial streams. Only four samples were obtained from wells. Wells are shallow, few in number, widely separated, and generally inaccessible.

GEOCHEMISTRY METHODS

Sample Collection

Field observation and sampling in the Raft River area were begun in early August, 1979 and completed in late October, 1979. Field work was concentrated in areas underlain by the Precambrian W and X (?) target lithologies. Samples were shipped to Oak Ridge Laboratory for analysis.

Laboratory analysis, as well as compilation and verification of all field and laboratory data, commenced in November, 1979 and continued through March, 1980. It was not possible, therefore, to follow-up or field check geochemical anomalies or questionable results. The final field and laboratory data base used to prepare the statistical and areal distribution of uranium and other related variables for this report was completed in May, 1980.

Sampling media included rock outcrops, stream sediments in ephemeral and perennial drainages, and stream, spring, and a very few well waters. Sample types are distributed as follows: four well waters, 214 stream waters, 116 spring waters (includes seeps), 616 stream sediment samples, and 264 rock samples. A total of 1214 geochemical samples were collected and analyzed. Distribution and location of the various sampling stations are shown on plates 2-4.

Obvious gaps in the sample coverage shown on plates 2-4 are due to a number of factors. The most notable are areas of private land ownership in the southern and eastern Raft River Mountains and scattered throughout the Dove Creek and Grouse Creek Mountains. Limited

access hampered field work in these areas. In addition, significant areas are underlain by Paleozoic and younger rocks which are not directly related to the present study objectives. Most notable are the eastern and northwestern parts of the Raft River Range, the western flanks of the Grouse Creek Mountains, and the western and northwestern flanks of the Albion Range.

The density and distribution of rock samples shown on plate 4 initially suggested that more rock samples would have been desirable in some areas, but hindsight indicates the additional coverage probably would not have changed the study results and conclusions. In any case, inclement weather, hunting, and heavy snow fall forced termination of all field work late in October, 1979.

Some random pH (47) and total-alkalinity (39) determinations were made in the field using a Corning model 3 pH meter and a Hach model AL-AP alkalinity test kit, respectively. No conductivity measurements were made. These pH and alkalinity data are included in appendix A. Instruments were checked and calibrated on a regular basis.

Sampling procedures and sample location data forms are discussed in some detail by Arendt and others (1979), in "Field Sampling Procedures" (Uranium Resource Evaluation Project, July, 1979), and in "Basic Instructions For Use Of Oak Ridge Geochemical Sampling Form By Bendix Field Engineering Corporation" (Uranium Resource Evaluation Project, June, 1979). Rock samples weighed at least one kilogram and consisted of five to 12 grabs which we randomly collected from

a few hundred square feet of outcrop. Routine field observations were recorded on the field form shown in table V.

Precautions were taken to avoid the possibility of collecting contaminated samples. Water containers were rinsed twice, but no filtration equipment, preservatives, or acids were used. Water and stream sediment samples were collected well upstream of potential pollution sites, such as bridges, culverts, and crossings. Only four well samples were collected. Wells were allowed to run several minutes, but contamination due to storage in and passage through galvanized tanks and pipes, respectively may still be present. Some springs discharge below water level into galvanized troughs, and a few of these exhibit anomalous zinc concentrations. Moreover, pollution of spring waters may result from cattle which graze freely and widely throughout the area. Springs serve as a common gathering point and a source of drinking water for cattle. By and large, however, samples are otherwise thought to be relatively free of contamination because the study area is mountainous and very sparsely populated.

Potential areas of contamination by commercial fertilizers and farming activities are restricted to the lowlands bordering Muddy Creek and the south fork of Junction Creek in the Grouse Creek Range, the north fork of Junction Creek and Birch Creek between the Albion and Grouse Creek Ranges, the Upper Narrows of the Raft River and Cassia Creek in the southern and northern Albion Range, respectively, and George Creek in the western Raft River Range (plates 2-3). The principal crop at all of these locations is alfalfa.

Table V.

Field Sampling Form

OAK RIDGE GEOCHEMICAL SAMPLING FORM

Card Number: 1

GENERAL SITE DATA

Attach Identical Sample Number Here

Site Number

Map Code

Sample Type

- Stream Sediment
- Lake Sediment
- Stream Water
- Well Water
- Spring Water
- Lake Water
- Bog Water
- Plant
- Soil (Use Remarks)
- Rock
- Other

Replicate Letter (A--Z)

Hour | Day | Month | Year

Collector's Initials

Phase (P, 1, 2, or G)

Field Sheet Status
- O Original
- C Correction
- V Voiding

Control Sample
- A Sediment, High U
- B Sediment, Low U
- C Water, High U
- D Water, Low U
- O Other

Air Temperature (°C)

Location

Latitude			Longitude		
Deg.	Min.	Sec.	Deg.	Min.	Sec.

Surface Geologic Unit Code

Type of Vegetation (Within 1 km Upstream)
- C Conifer
- & Conifer & Deciduous
- D Deciduous
- B Brush
- G Grass
- M Moss
- L Lichen
- O Other

Density of Vegetation (Within 1 Km Upstream)
- B Barren
- S Sparse
- M Moderate
- D Dense
- V Very Dense

Local Relief (Within 1 Km Upstream)
- F Flat (<2m)
- L Low (2–15m)
- G Gentle (15–60m)
- M Moderate (60–300m)
- H High (>300m)
- O Other

Weather
- C Calm
- P Lt Wind
- V Windy
- R V. Windy
- S Gale
- C Clear
- L Pt Cldy
- W Overcst
- V Rainy
- G Snowy

Classes of Contaminants
- N None
- M Mining (Use Remarks)
- A Agriculture
- F Oil Field
- I Industry
- S Sewage
- P Power Plant
- U Urban
- O Other

Average Stream Velocity (m/sec)

N = No Visible Movement
P = Stagnant Pool

Water Width (m)

Average Depth (m)

Water Level
- D Dry
- P Pools
- L Low
- N Normal
- H High
- F Flood

Dominant Bed Material
- B Boulder
- C Cobble
- P Pebble
- S Sand
- T Silt
- Y Clay
- N None (Use Remarks)

Sample Color (Except Plants)

Adj | Noun

- V V Lt
- L Light
- M Medium
- D Dark
- CL Clear
- WH White
- YL Yellow
- OR Orange
- PK Pink
- RD Red
- GN Green
- BU Blue
- BN Brown
- GY Gray
- BK Black
- OT Other

Odor of Sampled Material
- N None
- S H_2S
- O Other

Results Request (Use Remarks)

Card Number: 2

PLANT SAMPLE

Number of Plants Sampled (Number of grabs for moss)

Trunk Diameter (m) (1 m above ground)

Plant Height (m) (Average of Plants Sampled)

Name of Tree, Deciduous
- R Alto Verde
- A Ash
- B Beech
- I Birch
- D Box Elder
- F Cherry
- N Cottonwood
- E Elm
- H Hackberry
- C Hickory
- W Hoursache
- L Live Oak
- U Locust
- P Maple
- M Mesquite
- K Oak, Other
- V Olive
- Y Poplar
- S Sycamore
- T Salt Cedar
- G Walnut
- X Willow
- O Other

Name of Tree, Conifer
- A N. Wh. Cedar
- C Cedar, Other
- F Fir
- H Hemlock
- J Juniper
- L Larch
- P Pine
- S Spruce
- O Other

Name of Bush
- A Alder
- B Blueberry
- P Pussy Willow
- W Witch Hazel
- Y Yew
- O Other

Name of Moss
- P Peat
- S Sphagnum (live)
- O Other

Algae
- G Blue-Green
- B Brown
- O Other

Table V Cont.

Field Sampling Form

STREAM OR LAKE SEDIMENT

Sample Condition (31)
- D — Dry
- W — wet

Sample Treatment (32)
- N — None
- S — Sieved
- O — Other

(33, 34) Number of Grabs

(35, 36) % Organic Material (Field Estimate)

GENERAL WATER SAMPLES

Water Sample Treatment (37)
- N — None
- F — Filtered Only
- C — Acidified Only
- A — Acidified and Filtered
- O — Other

Depth of Visibility (m) (38, 39, 40)
C = Clear

(41, 42, 43, 44, 45) Conductivity (μmhos/cm)

(46, 47, 48) Dissolved O_2 (ppm)

(49, 50, 51) Temperature (°C)

(52, 53, 54) pH

(55) P — pH by Lo-Ion Paper.

(56, 57, 58, 59) Total Alkalinity (ppm)

(60, 61, 62, 63) P Alkalinity (ppm)

(64, 65, 66, 67) M Alkalinity (ppm)

Appearance of Water (68)
- C — Clear
- M — Murky
- A — Algal
- O — Other

(69, 70, 71, 72, 73) Discharge (liters/min)

(74, 75, 76, 77) Identification of Producing Horizon (Geologic Unit Code)

Confidence of Producing Horizon Identification (78)
- H — High Degree
- R — Probable
- S — Possible

Source of Producing Horizon Identification (79)
- P — Publication
- W — Owner
- U — User
- G — Geologic Inference
- O — Other

(1) 3 — Card Number

WELL WATER

Type of Well (18)
- D — Drilled
- P — Drive Point
- G — Dug
- U — Unknown
- O — Other

Power Classification (19)
- A — Artesian Flow
- E — Electric
- G — Gasoline
- W — Wind
- H — Hand
- O — Other

Casing (20)
- N — None (Below Water Table)
- S — Steel
- G — Galvanized
- P — Plastic
- U — Unknown
- O — Other

Pipe Composition (21)
- F — Steel
- Z — Galvanized
- C — Copper
- P — Plastic
- U — Unknown
- O — Other

Sample Location (22, 23, 24)
Meters from Well Head
H = Holding Tank (Use Remarks)

Where Sample Taken With Respect To Pressure Tank (25)
- B — Before
- A — After
- N — No Pressure Tank
- F — From Pressure Tank (Use Remarks)

Use of Well (26)
- M — Municipal.
- H — Household
- S — Stock
- I — Irrigation
- A — All of above
- X — H and S
- Y — H and I
- Z — S and I
- N — None
- O — Other

Frequency of Pumping (27)
- C — Constant (hourly)
- F — Frequent (daily)
- I — Infrequent (weekly)
- R — Rare (no recent use)

Depth to top of Producing Horizon (28, 29, 30, 31)
(Meters)

Confidence of Producing Depth (32)
- H — High
- R — Probable
- S — Possible

Source of Producing Depth Information (33)
- P — Publication
- W — Owner
- U — User
- G — Geologic Inference
- O — Other

Total Well Depth (34, 35, 36, 37)
(Meters)

Confidence of Total Depth (38)
- H — High
- R — Probable
- S — Possible

Source of Total Depth Information (39)
- P — Publications
- W — Owner
- U — User
- G — Geologic Inference
- O — Other

LAKE WATER

Type of Lake (55)
- N — Natural
- M — Manmade

Lake Area (56, 57, 58, 59)
(sq km)

REMARKS (Card 4)

Table V Cont.

Field Sampling Form

OAK RIDGE GEOCHEMICAL SAMPLING FORM

FIELD DATA SUPPLEMENT

Attach Identical Sample Number Here

Sequence Number

1

Procedure Number

Results for Procedure 31

Total Gamma - Scintillometer (counts/minute)

Results for Procedures 34-41

Variables and Procedures are listed below

Results for Precedure 32 Gamma Spectrometer

TOTAL COUNTS (CPM)

e POTASSIUM (%)

POTASSIUM (CPM)

e URANIUM (ppm)

URANIUM (CPM)

e THORIUM (ppm)

THORIUM (CPM)

Note To Sampler: Blocks 16-20 Not Used Should Be Marked Out.

DO NOT KEYPUNCH

Procedures 34–41.

34 Uranium (ppb)
35 Fluoride (ppm)
36 Nitrate (ppm)
37 Sulphate (ppm)
38 Phosphate (ppm)
39 Ferrous Iron (ppm)
40 Total Iron (ppm)
41 Turbidity (% T)

Readings made in Counts per _____

VARIABLE	READING		BACKGROUND		RESULTS
	ACTUAL	CPM	ACTUAL	CPM	
TOTAL COUNTS					
POTASSIUM					
URANIUM					
THORIUM					

UCN 11992A
(1 3-79)

A number of old and inactive mining districts occur in the study area. General locations are shown on plate 4. Most were small-scale operations founded in the late 1800's or early 1900's, were worked in some cases until the 1930's and have been idle since that time. Precious metals were the main commodities, but associated therewith were lead, zinc, copper, arsenic, and manganese. None of the mining districts are believed to be a major source of contamination per se, but the effects of mineralization are commonly discernible in water samples obtained from these areas.

Analytical Methods

Samples collected during each field period were returned to the Uranium Resource Evaluation Project (URE) laboratory in Oak Ridge, Tennessee for preparation and analysis. The elements determined, the analytical techniques used, and the detection limits of each method are shown in table VI. The reported detection limits are considered the best average during normal operations. For purposes of plotting, values below the detection limit were assumed to be one-half the detection limit.

Water samples were submitted in 250 ml polyethylene bottles and were vacuum filtered through a 0.45 um cellulose acetate paper prior to analysis. Stream sediments were shipped in Kraft waterproof sample bags (3½ x 6 1/8 inches), dried overnight at 85° C before processing,

Table VI

ANALYTICAL METHODS AND DETECTION LIMITS OF VARIABLES DETERMINED IN WATER, STREAM SEDIMENT, AND ROCK SAMPLES

Variable	Analytical Method	Detection Limits: Rock and Sediment (ppm)	Detection Limits: Water (ppb)
U-FL	Fluorometry	0.25	0.2
U-MS	Mass Spectrometry-Isotope Dilution	--	0.02
U-NT	Neutron Activation-Delayed Neutron Count	0.02	--
As	Atomic Absorption	0.1	0.5
Se	Atomic Absorption	0.1	0.2
Ag	Plasma Source Emission Spectrometry	2	2
Al	Plasma Source Emission Spectrometry	0.05(a)	10
B	Plasma Source Emission Spectrometry	10	8
Ba	Plasma Source Emission Spectrometry	2	2
Be	Plasma Source Emission Spectrometry	1	1
Ca	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
Ce	Plasma Source Emission Spectrometry	10	30
Co	Plasma Source Emission Spectrometry	4	2
Cr	Plasma Source Emission Spectrometry	1	4
Cu	Plasma Source Emission Spectrometry	2	2
Fe	Plasma Source Emission Spectrometry	0.05(a)	10
K	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
Li	Plasma Source Emission Spectrometry	1	4
Mg	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
Mn	Plasma Source Emission Spectrometry	4	2
Mo	Plasma Source Emission Spectrometry	4	4
Na	Plasma Source Emission Spectrometry	0.05(a)	0.1(b)
Nb	Plasma Source Emission Spectrometry	4	--
Ni	Plasma Source Emission Spectrometry	2	4
P	Plasma Source Emission Spectrometry	5	40
Sc	Plasma Source Emission Spectrometry	1	1
Si	Plasma Source Emission Spectrometry	--	0.1(b)
Sr	Plasma Source Emission Spectrometry	1	2
Th	Plasma Source Emission Spectrometry	2	--
Ti	Plasma Source Emission Spectrometry	10	2
V	Plasma Source Emission Spectrometry	2	4
Y	Plasma Source Emission Spectrometry	1	1
Zn	Plasma Source Emission Spectrometry	2	4
Zr	Plasma Source Emission Spectrometry	2	2
SO_4	Spectrophotometry	--	5(b)
Cl	Spectrophotometry	--	10(b)

(a) Detection limits expressed in percent.

(b) Detection limits expressed in ppm.

and sieved to collect the less than 100-mesh fraction which was analyzed. Part of the sediment and rock samples were dissolved in a 10 ml mixture of 1:1 nitric-hydrofluoric acid. Rock samples were submitted in Hubco cloth sample bags, ground to 100-mesh, split into fractions for analysis and archive records, and analyzed using the same procedures as for stream sediments. Basic processing and analytical procedures are described in greater detail by Cagle (1979) and Arendt and others (1977), to which the reader is referred for more information.

Quality Control

A standard form for recording field observations was developed by Oak Ridge Labobatory and was used in the present study (table V). It utilizes a quick checkoff system that minimizes misreading of the field information and allows quick key punching of the information onto two or more computer punch cards. Procedures for completing the form are discussed in a NURE report (June, 1979).

The procedures used by Oak Ridge to analyze samples require that calibration standards, check samples, and blanks be run along with normal samples to ensure the validity of the reported results. A measurement control program provides information concerning precision and reliability of the various measurements. Control samples of two water batches and two sediment batches are submitted anonymously along with routine samples on a daily basis.

A principal component analysis of the data was utilized to produce an ordered list of samples using the eigenvalue statistics as described by Kane and others (1977). Additional unusual samples were identified if single-element measurements were outside a three-standand deviation confidence interval around the mean. The laboratory and field data from the unusual samples identified by this procedure were reviewed. The only errors detected in this approach were sample coding errors wherein water, stream sediment, or rock samples were either miscoded in the field or incorrectly key punched.

Statistical Methods

Because of the large numbers of samples collected and the many analytical determinations made on each sample, computer processing and manipulation of the data greatly eased the burden of data presentation and interpretation, while at the same time facilitating identification of local and regional geochemical trends which may be related to uranium mineralization. Oak Ridge geologists, statisticians, and computer experts have combined talents and expertise in their respective fields to develop standard automated data processing and presentation schemes. These have been utilized in the present study and are described in more detail by Arendt and others (1979).

Standard computer output from Oak Ridge Laboratory includes summary statistics, correlation matrices, dendrograms (cluster analysis), log-

frequency plots, percentile plots, and geochemical plots with Canadian symbols for the various sample populations. These computer outputs are described in greater detail by Arendt and others (1979). The data acquired during this study were processed by these standard programs and are presented in their respective formats in the various tables and figures in appendices A, B, and C at the end of this report.

GEOCHEMISTRY RESULTS

Introduction

Statistical summaries, correlation matrices and cluster analyses (dendrograms) of selected geochemical variables of the water, stream sediment, and rock samples are presented in appendices A, B, and C, respectively. Areal distribution maps, log probability, log frequency, and percentile plots, and tabular data listings for selected variables are also included therein. A geologic map of major Precambrian W and X (?) units has been compiled at a scale of 1:125,000 from sources indicated thereon and comprises plate 1. Locations of all water, stream sediment, rock samples, radiation measurements, geochemical anomalies, airborne radiation anomalies and major mining districts have been plotted on topographic base maps at the same scale and are shown on plates 2 through 4. Cross-reference indexes tying sample numbers to geologic unit codes are included as tables A-VI, B-IV, and C-X in the appendices to this report.

Water Samples

Sampling sites for waters collected and analyzed during the study are shown on plate 2 at the scale of 1:125,000. A total of 334 water samples were collected. Sampling media included 116 springs and seeps, 214 streams, and 4 wells. The measured variables are those listed in the summary statistics in tables A-I through A-III. The corresponding basic data are listed under appropriate headings in table A-V.

Statistically significant correlations were obtained for the major and minor components of the waters shown in table A-IV because the waters

are dilute and most trace elements occur in concentrations near or below the detection limit for the method utilized(tables B-VI,A-I , and A-III). These conditions account for the relatively simple correlation matrix and dendrogram (cluster analysis) comprising table A-IV and figure A-1, respectively.

The water sample population is mostly stream waters by a ratio of almost 2:1. Well waters,which number only 4, are statistically insignificant. Comparison of statistical summaries for stream and spring waters (tables A-I and A-II) reveal more similarities than differences. Twenty-two variables (U, Ag, Ba, Co, K, Li, Mg, Mo, Na, Ni, Si, Sr, V, Zr, T-alkalinity, M-alkalinity, As, Se, SO_4, Na/Cl, 1000 U/SO_4, 1000 U/B) possess lognormal, or very nearly lognormal, distributions. Six other variables (Cr, Cu, Mn, P, Ti, Y) have distributions that are either lognormal or else occur below their respective detection limits when anomalous samples are not included. The remaining variables (Al, B, Ca, Fe, pH, Cl) have distributions composed of two or possibly three subpopulations. Mixing of stream and spring subpopulations apparently causes strong deviations from lognormality in the cases of Al and Fe (tables A-I and A-II). Bedrock lithology appears to exert the major control on B, Ca, and Cl. Chemical equilibria probably exerts the main control on pH, although bedrock lithology may indirectly influence equilibria.

The mean, median, and mode for 17 of the 33 variables for stream and spring waters are closely comparable (tables A-I and A-II). For three other variables (Ca, K, Sr), the mean and median are closely comparable but the modes differ significantly. Sparse pH data (47 measurements) indicate a relatively narrow range, 6.4 to 8.4. Spring waters are neutral and stream waters are slightly alkaline (tables A-I and A-II). Concentration

ranges are greater for spring waters (table A-II). This is to be expected because contact times are longer and favor more effective rock-water reactions in the subsurface.

The spring, stream, and well water data have been combined and are treated as a single population to minimize the number of illustrations and to facilitate discussion and interpretation. Pertinent statistical and chemical data are presented in tables A-III and A-V, respectively. The following discussion emphasizes the major relations that are reflected in the correlation and cluster analyses of variables and the areal geochemical plots.

Uranium

Summary statistics and basic geochemical data for spring, stream, and well waters are listed in tables A-I, A-II, A-III, and A-V. Logprobability and logfrequency plots of uranium concentrations in water samples are illustrated in figure A-2. The areal distribution of uranium in waters is shown in figure A-3 wherein concentration ranges are depicted by symbols utilized by the Canadian Geological Survey. For more details concerning these data formats the reader is referred to the publication by Arendt and others (1979). Sample sites, sample types, and anomalous waters are shown on plate 2.

Inspection of tables A-I and A-II reveals that spring waters exhibit the greater range, higher mode, and higher concentration of uranium, but the mean and median uranium contents of stream waters are slightly higher.

Uranium concentrations conform closely to a lognormal distribution even at higher concentrations, as is evident in figure A-2. The bimodal character of the logfrequency plot reflects two subpopulations with slightly differing distributions and probably results from combining the spring and stream water populations, as is suggested by comparison of the various statistics in tables A-I and A-II.

The areal distribution of uranium concentrations in water samples from the study area is shown in figure A-3. Uranium values above 4.33 ppb, which corresponds to the 85th percentile or one standard deviation above the mean uranium content for water, are arbitrarily designated as anomalous waters for the purposes of this report. Selection of 4.33 ppb uranium as the threshold admittedly results in too many waters being interpreted as anomalous. But if conventional procedures were adopted to define anomalies (mean or median plus two or three standard deviations), only a few water samples in the present study would qualify. Moreover, in geochemical exploration normal and anomalous samples cannot be selected solely on the basis of logprobability and logfrequency distributions of uranium or associated trace element concentrations, because in this case the samples corresponding to the formations with the higher background contents, or the samples of more mature waters, can appear anomalous (Dall'Aglio, 1973). Geochemical data are necessarily difficult to interpret because samples commonly comprise mixtures which have undergone natural processes of different kinds and intensity. In addition, a number of natural processes, notably evaporation, oxidation, and solution, give rise to high contents of pathfinder elements, even in the absence of mineral deposits.

Hydrogeochemical anomalies defined by one or two water samples are rather widely distributed in the Raft River area (fig. A-3 and plate 2). A total of 52 water samples with uranium contents equal to or greater than the 85th percentile were delineated. In terms of sample type, springs account for 15 anomalies, streams 36 anomalies, and wells one anomaly (plate 2). With respect to geography, 29 anomalies occur in the Grouse Creek Mountains, three in the Dove Creek Mountains, seven in the Raft River Mountains, and 13 in the Albion Range (plate 2).

Comparison of the geologic map of Precambrian units (plate 1) with data shown on plate 2 and figure A-3 suggests that the major control on uranium concentrations in waters is bedrock lithology. Out of a total of 52 hydrogeochemical anomalies, 37 occur in waters which either discharge from or drain rocks of the Green Creek Complex (plate 2, anomalies 2-20, 24-30, 36, 40, 41, 44, 45, 47-49). Geologic maps (Compton, 1972, 1975) and field observations indicate adamellite or its metamorphosed equivalent, adamellite gneiss, is the most widespread lithology in the Green Creek Complex, but notable amounts of schist, trondhjemite, pegmatite, and amphibolite may occur locally (plate 1). Of these lithologies, the first four contain a relatively high soluble (fluorometric) and high total (neutron activation) uranium content (fig. C-2 and C-3). Moreover, excluding the Elba Conglomerate and Precambrian X (?) schists, these lithologies are also the most radioactive rocks in the study area (figs. C-12 through C-15). The strong correspondence between lithology, principally adamellite, and high uranium contents and extensive exposures of adamellite probably account for the observed relationship (table C-II and figs. C-2 and C-3).

Bedrock lithology, both with and without associated sulfide mineralization, also exerts a strong control on the remaining 16 anomalies. Precambrian X (?) conglomerate and schist, also known to be uraniferous and radioactive (tables C-IV and C-V and figs. C-2, C-3, and C-12 through C-15), occur in association with seven uraniferous waters whose geologic setting precludes any significant contribution of dissolved components from silicic rocks of the Green Creek Complex(plate 2, anomalies 31, 32, 34, 35, 38, 42, 46). Precambrian X (?) rocks are also present in the drainage areas from which 15 of the 37 uraniferous waters ascribed mainly to the Green Creek Complex were collected.

Tuffaceous, fluvial-lacustrine, basin-fill sediments with intercalated quartz latite ash flow tuffs underlie extensive areas from which five uraniferous waters were obtained (plate 2, anomalies 21-23, 33, 43). Two other anomalies (plate 2, anomalies 1 and 37) coincide with localities underlain by allochthonous sheets of Paleozoic rocks, mainly carbonates, which contain some associated base and precious metal sulfide mineralization. The source of the uranium in one of these uraniferous waters (plate 2, anomaly 1) is probably related to Archean and Oligocene adamellites which comprise bedrock nearby. One water sample obtained from the Raft River Range northeast of the Upper Narrows contains anomalous U, Ba, Li, Sr, Zn, and As (plate 2, anomaly 39). Intermediate sulfate and high chloride contents suggest extensive solution of rocks in the drainage basin which includes an extensive area upstream underlain by uraniferous rocks and sediments of Archean through late Tertiary age. Anomaly 39, therefore, likely owes its existence to the related effects of bedrock solution and salinity.

A pronounced clustering of uraniferous waters occurs in the central Grouse Creek Mountains (fig. A-3; plate 2, anomalies 2-20). Twenty-one anomalous waters comprise this cluster. Most occur around the perimeter of a large Archean adamellite outcrop which also includes, within its boundaries, two smaller areas of Oligocene adamellite (plates 1-2). Moreover, most of the uraniferous waters exhibit a close relationship to high-angle and low-angle faults, which are located mainly around the perimeter of the Precambrian W adamellite but also transect the northern lobe at Pine Creek (plates 1-2).

Although metamorphosed Paleozoic rocks occur in allochthonous sheets around the perimeter of this cluster, they are unlikely sources of uranium because most are marine carbonates. With only two exceptions (plate 2, anomalies 1 and 37), waters collected from terranes underlain by Paleozoic rocks are notable for their low uranium concentrations. Further evidence of this is the low uranium contents of samples just southeast of Stanrod, within and northeast of Clarks Basin, and at the northwest perimeter of the Albion Range (fig. A-3 and plate 2).

Both hydrothermal and pyrometasomatic mineralization occurs in the general area of Red Butte. Mineralization in the central Grouse Creek Mountains is related to several adamellite plutons of late Oligocene age (25 m.y.). Mines were mostly small-scale operations which recovered ores of tungsten, gold, silver, and copper from veins and contact zones, in Paleozoic carbonate rocks bordered by Precambrian adamellite shown on plate 1.

No occurrences or past production of uranium minerals are known from the Central Grouse Creek Mountains. PRR #5055 may correspond to some mine(s) within or around the perimeter of the cluster of uraniferous waters, but no radioactivity or uranium values were reported. The stated location is in error, but the reported facts are otherwise in agreement with those observed. No significant anomalous radiation was detected during the geochemical sampling. During a recent airborne radiometric survey, however, three anomalies were detected and are shown on plate 4 as anomalies 19-21.

Uraniferous waters, comprising the prominent cluster of anomalies in the central Grouse Creek Mountains, contain a variety of associated trace elements (table A-I). The number of these elements permits recognition of two subgroups of questionable significance. The subgroup with the larger number of water samples is characterized by a simple trace element suite containing uranium and at most two other elements. The other subgroup contains uranium and a variety of other trace elements which are associated with silicic or mafic rocks and sulfide mineralization.

Evidence in support of uranium mineralization consists of the following: (1) the magnitude, frequency, and areal distribution of the uraniferous waters, (2) the presence of sulfide mineralization, (3) the highly variable suite of associated trace elements, (4) the combined effects of regional metamorphism and intrusion, (5) the anomalous area displays the highest metamorphic grade exposures of the autochthon, and (6) the present erosional surface coincides closely with the structural level of maximum metamorphic deformation in the Precambrian adamellite.

The geology of the central Grouse Creek Mountains is compatible with the original model of magmatic differentiation in the Precambrian adamellite, subsequent redistribution and/or addition of mobile elements to the present structural level by regional metamorphism, and/or Oligocene intrusion. Relatively recent tectonic and/or erosional unroofing permitted chemical weathering of the deformed and mineralized adamellite and allochthonous Paleozoic rocks. These conditions may have generated formation of uraniferous veins or very weakly disseminated uranium mineralization in proximity to structural and/or compositional discontinuities. On the other hand, these processes may have merely rendered the adamellite more susceptible to chemical weathering and solution. The effect of sodium metasomatism on the adamellite gneiss by intrusions of Oligocene adamellite is obvious from petrographic studies (Todd, 1973). It is also evidenced in the high statistical and areal distributions of sodium, calcium and aluminum (tables B-II and C-III and fig. B-8), but appears to exert little, if any, influence on uranium. In either case, the uranium and associated trace elements in this area suggest deviation from the Green Creek Complex where a reservoir of elements with silicic, mafic, and sulfide affinities exists. This is hinted at by both the areal distribution of uraniferous waters and the highly variable and incompatible trace elements. Most of the remaining hydrogeochemical anomalies are single or, at most, triple point anomalies of dubious significance. None is believed to signify uranium mineralization with economic potential, although several occur within or near areas in which uranium minerals are known.

Anomalies 48 and 49 (plate 2) represent stream and spring waters respectively that were collected in Conner Creek Canyon, another area of known sulfide mineralization. In this area, known as the Ward mining district, samarskite occurs as a minor constituent in quartz-feldspar metamorphic segregations in an Archean schist (Bill Gallant, oral communication, 11/13/79). This area has been thoroughly prospected, as is evident by the number and distribution of old adits and digs. Ores were mined for gold, silver, lead, copper, zinc, molybdenum, cobalt, and nickel associated with sulfide mineralization in mesothermal veins and replacements. This metal suite is noteworthy because it compares closely to that associated with classical uranium veins and some Proterozoic unconformity-type uranium deposits (McMillan, 1978). In the Connor Creek area, however, it appears that uranium was not introduced in sigificant amounts with the sulfide mineralization.

No uranium occurrences, other than the samarskite previously described, or past production are known for the Conner Creek area. Although the stated locations shown in PRR Nos. 2500 and 2501 do not coincide with the mining district, their descriptions match. A maximum radiation level of 200 cps was reported inside mine adits in contrast to 40 cps on dumps and in prospect pits. No uranium minerals were reported nor was any follow-up recommended. The reported radiation level in adits was not ascribed to any origin, but probably resulted from radon buildup because of poor circulation. Radiation levels comparable to, or slightly higher than, 200 cps on a GR-101A scintillation counter are common for silicic lithologies in the Green Creek Complex as well as for Precambrian X (?) conglomerate and schist.

Thus, the uranium and associated trace elements in the spring and stream waters of Conner Creek Canyon likely derive from chemical weathering of the widespread uraniferous rocks known to occur throughout the drainage basin. A minor contribution may be supplied by oxidation of sulfides, but this is not regarded as an important source or process in this area in the absence of sulfate anomalies.

Anomaly 41 is located only a few miles southeast of a uranium occurrence in pegmatite and airborne anomaly 8 (plate 2 and 4). It represents a stream sample collected from the lower reaches of a creek which drains Archean and Oligocene adamellites, as well as Elba quartzite and conglomerate (plate 1). The cause of the anomly is believed to be extensive solution of uraniferous rocks in the drainge basin, as is suggested by a high chloride content. Oxidation of sulfides is hinted by an intermediate sulfate content, but elsewhere in the study area much higher sulfate values typically occur in areas with known sulfide mineralization. According to Bill Gallant (oral communication, 11/13/79), samarskite occurs in a pegmatite in section 36 T. 15 S., R. 23 E., and uranium contents up to 40 ppm occur in aplite dikes further to the north in the Castle Rock area. Cook (1955, 1957) also reported uranium minerals, both in place and in placers, in this general area, known as the City of Rocks, but specific locations were not provided. Notwithstanding these uranium occurrences and the airborne anomaly, the uranium potential of this area is of no consequence from an economic viewpoint.

Anomalies 31, 32, 34, 35, 38, 42, and 46 are grouped together because they share similarities with each other but differ in some important respects from the other anomalies. The similarities are two-fold. First, Precambrian X (?) lithologies predominate in the drainage basins from which the anomalous waters were obtained (plates 1-2). Schists and conglomerate are known to be uraniferous, as is indicated by percentile plots of uranium concentrations in rock samples (tables C-IV and C-V and figs. C-2 and C-3), and they are also radioactive (figs. C-12 through C-15). In contrast, all quartzites in the study area contain low uranium values (fig. C-2 and C-3) and exhibit low radioactivity (fig. C-12 through C-15). Therefore, waters from quartzite terranes contain low uranium contents. Proof of this is reflected in the east-west and northwest-southeast trending geochemical depressions in the northern Albion Range where uranium values fall below the 15th percentile (fig. A-3). Thus, quartzites, regardless of age, are poor sources of uranium, and they exhibit anomalous radioactivity only in some areas of known sulfide mineralization, locally yielding counts comparable to that obtained for schists, adamellite, trondhjemite, and pegmatite.

The second point of similarity relates to the geologic setting of the drainage basins from whence the anomalous samples were collected,which precludes a significant contribution of dissolved components from silicic lithologies in the Green Creek Complex (plates 1-2). Thus, the source of the anomalies necessarily resides in the conglomerate and schists or else is attributable to uranium mineralization. The latter possibility, which is hinted by the presence of trace element anomalies in some

of the uraniferous waters, is considered to be highly unlikely, particularly for anomalies 34, 35, 42, and 46. These anomalies probably stem from simple chemical weathering and solution of uraniferous schists and conglomerate in their respective drainage basins. This interpretation is based on similar chemistries, simple trace element suites, the lack of anomalous radioactivity in their drainage basins, and uranium contents just above the threshold value of 4.33 ppb. Anomalies 31, 32, and 38 are also interpreted to be unrelated to uranium mineralization with economic significance, but they are discussed in more detail hereafter because of a similar but somewhat different origin.

Anomalies 31, 32, and 38 share somewhat similar geologic settings and genesis. All three represent springs situated at low elevations with respect to their catchment areas. Moreover, their drainage basins are underlain only by Precambrian X (?) quartzite and schist, except for anomaly 31, which includes conglomerate. Trace elements in these three uraniferous waters vary somewhat but more importantly, all three exhibit strong sulfate and chloride (salinity) anomalies. The Elba and Yost quartzites are both known to be weakly but pervasively mineralized with epigenetic pyrite throughout large areas of the Raft River Range. The Elba, Upper Narrows, and Stevens Spring schists may be similarly mineralized. Therefore, geologic settings and geochemical characteristics of these three waters suggest that pyrite oxidation promotes solution of mobile elements in the quartzites and schists and results in the development of uranium and trace element anomalies at points of groundwater discharge.

This interpretation is further reinforced by the conspicuous train

of subanomalous stream waters collected from Johnson Creek (fig. A-3). Johnson Creek drains an area with similar geology, is located only a few miles west of anomalies 31 and 32, and has a past history of small-scale mining activity for precious metals.

In the George Creek-Charleston Creek-Johnston Creek area the Elba Quartzite is weakly but pervasively mineralized with epigenetic pyrite, presumably of hydrothermal origin, and local outcrops were measured up to 200 cps, which is four times the response of typical Elba or Yost Quartzite. Oxidizing surface water entering fractures in the overlying Elba Schist apparently mobilizes uranium and other soluble elements which in turn are carried downward into ubiquitous fractures in the Elba Quartzite where iron hydroxides absorb uranium as the water evaporates at the outcrop. Similar conditions, although without anomalous radiation, were also noted in the Right Hand Fork of Johnson Creek and in the Century Hollow area. If this process were operative along the divide between the Left Hand Fork of Johnson Creek and Charleston Creek, it would explain the airborne anomaly discovered there (plate 2).

Anomaly 40 is defined by two uraniferous springs that are situated in close proximity to each other in the Cedar Hills of the southern Albion Range (plate 2). They occur at or just below the unconformity between the Elba Quartzite and the underlying Archean adamellite (plate 1). Their chemistries are strikingly similar notwithstanding the distance of separation. Both contain detectable and, therefore, somewhat anomalous contents of boron, lithium, molybdenum, strontium, and arsenic. In addition, zinc occurs in one and barium in the other. Both exhibit sulfate and

chloride anomalies. In many respects, anomaly 40 (two point) resembles anomalies 31 and 32. Nonetheless, these anomalous waters probably derive most, if not all, of their somewhat unique characteristics from the processes of pyrite oxidation and accompanying solution of bedrock lithologies by acid sulfate waters. While all of the anomalies attributed to these processes probably merit additional sampling and field checking (anomalies 31, 32, 37, 38, 40, and 41), none is believed to signify uranium mineralization with economic potential.

The geologic and hydrologic settings of anomalies 21-23, 33, and 43 are similar to each other. All four localities include extensive exposures of tuffaceous, fluvial-lacustrine, basin-fill sediments of late Miocene and Pliocene age. Intercalated or overlying quartz latite ash flow tuffs are also common. Anomalies 21-23 and 43 represent stream waters whereas anomaly 33 is from a well located at the old white school house in the village of Yost. Although Elba Quartzite and allochthonous sheets of Paleozoic carbonates comprise extensive outcrops at higher elevations in the drainage basins of anomalies 21-23 and 33, they are not likely sources of uranium. Waters collected from terranes composed predominantly of quartzite and carbonate typically exhibit low uranium concentrations. Proof of this is evidenced by the east-west and northwest-southeast trending geochemical depressions in the northern Albion Range (fig. A-3). Moreover, in Goose Creek Basin, which is located just west of the study area, similar tuffaceous sediments contain uranium and yield uraniferous waters (Mapel and Hill, 1959). Thus, the contained uranium and associated trace elements, namely arsenic, selenium, silver, lithium,

boron, barium, and strontium, probably stems from leaching of the abundant and widely distributed volcanic ash in these Tertiary sediments by oxidizing waters.

The conditions and interpretation just described are also applicable to anomaly 43, but some uranium in this water and the associated subanomalous waters of Birch Creek may derive from weathering of extensive exposures of Archean and Oligocene adamellites in the east facing slopes of Middle Mountain, which is located just west of and trends parallel to Birch Creek (fig. A-3 and plates 1-2). The uranium content of Oligocene adamellite is not known, but sparse radiation measurements suggest that it may be comparable locally to rocks of Archean age. Anomalies 33 and 43 barely exceed the threshold value of 4.33 ppb.

Anomalies 1 and 37 represent a stream and spring water, respectively, that were obtained from areas underlain by extensive exposures of Paleozoic rocks, mainly carbonates, that are known to be mineralized with sulfides. Anomaly 1, however, contains low sulfate and intermediate chloride and is chemically similar to uraniferous waters located well upstream of the sampling point and situated along the east margin of the prominent cluster of anomalies in the central Grouse Creek Mountains. The origin of this anomaly, therefore, is believed to be the same as that of the others comprising the cluster and is, for the most part, probably unrelated to the Paleozoic rocks and alluvium underlying the sampling site.

Anomaly 37 is a spring near the Skoro mine, located just below and west of the crest of the Vipont Range (plate 2). Allochthonous Paleozoic rocks predominate locally and are mineralized with sulfides of silver,

lead, zinc, copper, arsenic, and iron and carbonates of lead, manganese and copper. Gold is also reportedly present. The mineralization is related to the synkinematic Vipont Mountain intrusion of unknown age. This area is also known as the Ashbrook mining district in the older literature and figures prominently in Utah's past silver production statistics. The known mineralization is reflected in the chemistry of the uraniferous water. Uranium contents of waters collected from this area range from 2 to 6 ppb (plate 2 and table A-V). The source of the uranium and associated trace elements is related to the sulfide mineralization and derives from oxidation of pyrite and solution of carbonates by acid sulfate waters, as is evidenced by the high calcium and strontium concentrations, high sulfate and intermediate chloride contents, and the downstream disappearance of the anomaly. Thus, the barely anomalous and subanomalous uranium contents of waters from Paleozoic rocks in the Ashbrook mining district probably do not reflect uranium mineralization.

The efficiency of the process of pyrite oxidation is manifested in the fact that anomaly 37 is the only uraniferous water known to originate in Paleozoic rocks in the study area. While anomaly 1 coincides geographically with mineralized Paleozoic rocks, it is likely related mainly to the processes responsible for the cluster of anomalies well upstream of the sampling point that appear to be entirely unrelated to oxidation of pyrite.

Generally speaking, if uranium mineralization of economic significance had accompanied the sulfide mineralization known to occur at a number of

localities in the Raft River area, one would expect much more pronounced hydrogeochemical anomalies in the presence of oxidation. However, even in the absence of important uranium mineralization, hydrogeochemical anomalies are to be expected in areas of oxidizing sulfides and accompanying solution of bedrock by acid sulfate waters because this process is very effective in mobilizing soluble elements. The efficiency of the process is believed to account entirely for anomalies 31, 32, 38, and 40 and probably figures prominently in anomalies 39 and 41. It may likewise contribute somewhat to anomaly 11 in the central Grouse Creek Mountains.

Variables Related to Uranium

Calculation of Pearson (linear) and Spearman (nonlinear) correlation coefficients permitted determination of the variables that are related statistically to uranium (table A-IV). Correlation coefficents for most other trace elements are lacking because the sample population contained an insufficient number of analyses to permit calculation of statistically significant values. Pearson and Spearman correlation coefficients exist for uranium and sulfate (0.25***/0.26***), for uranium and chloride and for uranium and iron(-0.31 ***/-0.27***), but they are not included in appendix A; neither are the Spearman correlation coefficents obtained for uranium and arsenic (0.32***) and for uranium and silver (0.25***).

Cluster analysis of the correlation matrix facilitated recognition of the variables statistically related to uranium (fig. A-1). Generally speaking, variables in the different groups are not as highly correlated

as the variables within the same group. These groups are indicated in table A-IV where they are separated by a heavy black line. For more details concerning the calculations and significance of the statistical parameters previously mentioned, the reader is referred to the publications by Arendt and others (1979) and by Snedecor and Cochran (1967).

Correlation and cluster analyses of the variables result in a relatively simple correlation matrix and dendrogram for water samples in the Raft River area (table A-IV and fig. A-1). Collectively speaking, the data contained therein point to chemical weathering, bedrock lithology, and sulfide mineralization as the three major controls on the composition of waters.

This same conclusion was deduced independently in the preceding section on uranium on the basis of the strong spatial correlations noted between certain stratigraphic units or lithologies, with or without associated sulfide mineralization, and occurrences of uraniferous waters. Moreover, these data and those shown in figure A-3 are consistent with the interpretation that, for the most part, uranium concentrations in waters of the study area derive from the mechanical and chemical weathering and solution of uraniferous Precambrian W and X (?) lithologies, which, on the average, contain only clarke uranium values. The possibility of economic uranium mineralization in the central Grouse Creek Mountains where a prominent cluster of uraniferous waters occurs, is not precluded by the data, but it is not considered to be a strong possibility either. The data in figures C-2 and C-3 permit recognition of the most likely sources of the uranium, namely the Archean adamellite and schist and

and Precambrian X (?) schists and conglomerate. As previously mentioned, these are also the most radioactive lithologies.

The high correlations between as well as the clustering of silicon, potassium, and barium in table A-IV and figure A-1, respectively, is interpreted to signify the mechanical and chemical breakdown of common feldspar, biotite, and ferromagnesian minerals, all of which are susceptible to weathering. Quartz is quite resistant and contributes little, if anything, to ordinary surface and shallow subsurface waters. Excluding all quartzites and the Elba conglomerate, the Precambrian W and X (?) lithologies constitute a large reservoir of all of the elements shown in figure A-1 except arsenic and sulfate. The distribution of these two components in rocks of the study area is unknown, but is probably insignificant in comparison with others listed.

Boron, sodium, chloride, and lithium are all highly correlated and comprise the second cluster shown in figure A-1. The correlation and clustering of these four variables reflect their high geochemical mobility in the supergene environment as well as their high solubility in water. Therefore, any one or all four of these variables may be used as an indicator of the relative salinity or maturity of a water. Similarly, uranium, possessing high geochemical mobility in oxidizing waters, tends to dissolve in proportion to these and other highly soluble elements in waters (Dall'Aglio, 1973, 1974). Thus, the high correlations between uranium and these four mobile elements in waters of the study area are interpreted to mean that the generally observed relationship between

salinity and uranium concentration accounts for a large proportion, but not necessarily all, of the dissolved uranium. Exceptions appear to include 10 of the 21 uraniferous waters in the central Grouse Creek Mountains (table A-V). Others uraniferous waters, notably anomalies 12, 24, 26-28, 31 23, 36, and 38-41, apparently conform to this relationship. In addition, anomalies 1, 4, 5, 10, 11, 15, 17, 18, 20, 21, 25, 28, 33, 35, 43, and 47 all contain intermediate chloride values and may owe their anomalous uranium contents in part or totally to the effects of bedrock solution and the related effects of salinity.

The areal distribution of sodium concentrations in waters is shown in figure A-4. The most conspicuous pattern revealed in this map is that the waters with lower sodium concentrations occur in areas of high precipitation and recharge at the higher elevations in the mountains. This is the expected pattern under conditions of increasing solution or salinity in the down gradient direction, which is evident in the nearby concentric arrangement of concentrations symbols over the Raft River and Albion Range. This pattern, however, is not evident in the central Grouse Creek Mountains where uraniferous waters abound. Moreover, comparison of figures A-3 and A-4 indicates that salinity anomalies are not always coincident with uranium anomalies in the latter area. The expected increase in sodium (or salinity) in the downstream or down gradient direction is clearly seen in George Creek, Charleston Creek, and Johnson Creek in the northwestern Raft River Mountains; by Wildcat Creek and Dove Creek in the Dove Creek Mountains, and by Pine Creek and its

counterpart on the east slope in the central Grouse Creek Mountains (plate 2 and fig. A-4). The obvious geochemical lows in the Albion Range coincide with extensive exposures of Precambrian X (?) and Z (?) quartzites, whereas the conspicuous high southwest of Yost corresponds to the confluence of four of the previously mentioned streams exhibiting salinity gradients.

The third group of highly correlated and clustered variables includes calcium, magnesium, and strontium (fig. A-1). Comparisons of their geochemical plots (not included in appendix A), revealed patterns strikingly similar to those of sodium (fig. A-4). Major drainages reveal downstream increases in concentrations of these three variables, and significant deviations from the sodium pattern occur only in waters collected from or located in proximity to Paleozoic carbonate rocks where pronounced calcium, magnesium, and strontium anomalies exist with or without associated sodium anomalies. Geochemical lows coincide with quartzite terrane. This group of variables are interpreted to reflect the same processes previously mentioned, that is, chemical weathering and solution of bedrock, both of which account for the high correlations observed between uranium and elements of this group (table A-IV). All of these elements have comparable geochemical mobilities in the supergene environment and proven high solubilities in water. Moreover, a large reservoir of these elements resides in nonquartzite lithologies of Precambrian W and X (?) rocks as well as in extensive exposures of Paleozoic carbonates in the allochthonous sheets. Blank geochem patterns on the sawtooth side of the low-angle faults shown on plate 1 invariably coincide with Paleozoic allochthons.

One might be tempted to interpret the strong three-way correlations between calcium, magnesium, and strontium to signify predominantly solution of carbonate rocks, but the geochemical plots clearly showed some clusters of anomalies totally unrelated to carbonate rocks. However, the correlation between uranium and these three variables becomes strained because uranium content of waters from carbonate terranes is typically low, suggesting low indigenous uranium values.

Iron, arsenic, and sulfate exhibit strong correlations with uranium in waters. The first is negative and the latter two are positive. These three variables and uranium are related through a common process, namely oxidation. The negative correlation between uranium and iron is compatible with their respective oxidation states in oxidizing waters. Uranyl ion is highly soluble,but iron forms insoluble ferric hydroxides which soon precipitate. High iron concentrations, therefore, are to be expected in waters with low Eh where, correspondingly low concentrations of uranium would prevail because of the low solubility of uranous oxide.

The statistically significant positive correlations obtained for uranium and arsenic (0.32***) and for uranium and sulfate (0.25***/0,26***) are both believed to be related to the locally important process of pyrite oxidation mentioned in an earlier section. Pyrite and arsenopyrite mineralization is known to exist in the Ward, Ashbrook, Johnson Creek, Century Hollow (also known as Park Valley), and Rosebud mining districts. It is also suspected to occur at a few other localities based on hydrogeochemical results (table A-V). The formation of uranyl sulfate complexes enhances the solution of any uranium present. The correlation

between uranium, arsenic, sulfate, and iron is in light of known sulfide mineralization, interpreted to reflect oxidation of pyrite and arsenopyrite. This process probably accounts for anomalies 31, 32, 37, 38, and 40 and may contribute to anomalies 11, 39, and 41 (plate 2).

It is doubful that economic uranium mineralization occurs with the sulfide mineralization for two reasons. First, it is almost inconceivable the prospectors with scintilliation counters would have missed the known mining districts during the frenzied exploration of the 1950's. Most were discovered in the late 1800's or early 1900's and they are all conspicuous because of good access, numerous adits, mine dumps, and countless prospects pits. Secondly, the magnitude of the anomalies would be expected to be significantly higher in the presence of economic uranium mineralization accompanied by oxidizing sulfides. As a precautionary measure, therefore, some of these hydrogeochemical anomalies should be field checked in more detail since recent airborne surveys detected 5 radiation anomalies over areas of known or suspected sulfide mineralization (plate 4, airborne anomalies 8, 10, 13, 15, and 19). Four of the five airborne anomalies correspond closely to areas characterized by hydrogeochemical anomalies (plate 2, anomalies 11, 31, 38, and 40). In some instances, stream sediment and rock anomalies also coincide with or occur in proximity to the hydrogeochemical anomalies (plates 2-4). The sources of the airborne anomalies remain essentially unverified. They may be related to uranium mineralization, or , as the writer suspects, they may originate in connection with pyrite oxidation and adsorption of minute amounts of uranium by the resulting ferric hydroxides, in much the same way as observed by Lovering (1955) in his study of

radioactive limonites. Only small amounts of uranium would be required to generate a radiation anomaly, since even the most uraniferous rocks of the study area contain on the average less than 3 ppm uranium or approximately clarke amounts (tables C-I through C-VII and figs. C-2 and C-3).

Uranium and silver also correlate positively (Spearman, 0.25 m.y.). This correlation is further evidence of the process of pyrite and arsenopyrite oxidation. Silver was the main precious metal associated with the sulfide mineralization in most of the previously mentioned mining districts (plate 4). Thus, during the oxidation of base and precious metal sulfides, anomalous concentrations of some metals might be expected in the acid sulfate waters, particularly those with moderate to high geochemical mobility in supergene environments and moderate to high solubility in water.

Trace elements contents of waters in the Raft River area, excluding the highly soluble and common rock-forming trace elements, exhibit marked variations from one sample to another and typically occur below the detection limit of the analytical method utilized (tables A-I and A-III). Those correlated with uranium have already been discussed. A number of other elements exhibit statistically significant correlation coefficents with each other despite the small sample populations (not included in Appendix A). These will not be discussed individually because the data are sparse and interpretation thereof is fraught with difficulty. Available data, however, suggest that most, if not all, of the anomalous concentrations of trace elements in waters may be readily explained by chemical weathering of mineralized

rocks or alluvium containing sulfides and/or the common accessory and pegmatite minerals. Thus, anomalous concentrations of trace elements in waters may derive from any one or a combination of these situations.

Stream Sediment Samples

A total of 616 stream sediment samples were collected from the Raft River area. Sampling sites as well as anomalous samples are shown on plate 3. Areas on plate 3 for which sample coverage is sparse or entirely lacking are either underlain by rocks having no potential for the type of uranium deposits sought, or they correspond to areas of private land ownership and limited access. Sample coverage otherwise is considered to be satisfactory. Thirty-one variables were measured and they are listed in the summary statistics in table B-I, appendix B. The corresponding data are included in table B-III, appendix B. Statistically significant correlations were obtained for most variables and are shown in table B-II appendix B. The results of cluster analysis of the correlation matrix are graphically illustrated in figure B-1. The areal distributions and concentrations of seven variables (Uf, Ut, K, V, Th, Na, Be) for stream sediment samples are shown in figures B-3 through B-9, appendix B.

Examination of the summary statistics for stream sediment samples reveals that all of the variables, except silver and molybdenum, occur in concentrations above the detection limit of their respective analytical method (table B-II, and fig. B-1, app. B). Of the 31 variables measured, 23 have distributions in which the mean, median, and mode are closely comparable, indicating a high degree of symmetry for the corresponding logfrequency distributions. Logprobability plots of concentrations show 24 of the variables exhibit lognormal or very nearly lognormal distributions. Exceptions include uranium (fluorometric and neutron

activation), boron, calcium, copper, niobium, and zirconium. Deviations from lognormality, whether weak or pronounced, relate to differences in concentration distrubutions for each of the major lithologies in the study area. These differences are clearly indicated by the variables in their respective statistical and areal geochemical plots for water, stream sediment, and especially rock samples. In some instances the deviations relate to sulfide mineralization or sodium metasomatism of adamellite gneiss by Oligocene intrusions.

Consideration of the various statistical data permits recognition of 79 anomalous stream sediment samples for uranium fluorometric or acid soluble, Uf, and neutron activation or total, Ut. Anomalous stream sediment samples are arbitrarily defined to be samples in which both Uf and Ut concentrations equal or exceed the 85th percentile of their respective logprobability distributions. This corresponds to 7.2 ppm and 9.5 ppm for Uf and Ut, respectively (fig. B-2, app. B), each of which is equivalent to one standard deviation above the mean Uf and Ut contents for stream sediment samples. This dual requirement results in slightly fewer anomalous stream sediment samples (plate 3) than on the respective geochemical plots of Uf and Ut (figs. B-3 and B-4, app. B).

Uranium

Inspection of table B-I, appendix B, reveals the mean, median, and mode for both Uf and Ut differ significantly from each other. For Uf they are 6.2, 3.3, and 2.7 ppm, respectively, whereas for Ut

they are 7.6, 4.7, and 4.1 ppm, respectively. The range of both variables is comparable, 0.7 to 103 ppm and 0.9 to 102 ppm for Uf and Ut, respectively. As might be expected from such contrasting statistics, the logprobability distributions of Uf and Ut concentrations in stream sediments are not lognormal (fig. B-2, app. B). Deviations from lognormality are greatest at the higher Uf and Ut concentrations. Interestingly, the logprobability distributions of both variables exhibit nearly identical patterns (fig. B-2, app. B), suggesting both are highly correlative and possibly share a common explanation. This is also indicated by the logprobability plot of the ratio, Uf/Ut, which closely approximates lognormality (fig. B-2, app. B), and a statistically significant, positive, and high Pearson correlation coefficient of 0.93 for these two variables (table B-II, app. B). Additional evidence supportive of this interpretation is also contained in the respective geochemical plots of these two variables (figs. B-3 and B-4).

The areal distributions of Uf and Ut concentrations are shown in figures B-3 and B-4, appendix B, wherein concentration ranges are depicted graphically by standard symbols of the Canadian Geological Survey. The areal distribution patterns for Uf and Ut are practically identical. Moreover, both geochemical patterns are similar to those for uraniferous waters (fig. A-3, app. A). That is, stream sediment anomalies likewise exhibit strong lithologic preferences. In addition, they commonly occur with, or very near, hydrogeochemical anomalies. The geographic and lithologic correspondences are readily apparent from a comparison of plates 1 and 3. Of the 79 stream sediment anomalies

delineated, 34 occur in the Grouse Creek Mountains, 29 are in the Raft River Mountains, and 16 are in the Albion Range, but none are located in the Dove Creek Mountains. With respect to bedrock lithology, the correspondence is even more marked with 24 anomalies occurring in drainage basins underlain by Green Creek Complex, mainly adamellite gneiss; 31 by both Precambrian W and X (?) lithologies; six by Precambrian X (?) rocks; one by Paleozoic and Precambrian Z (?) quartzite, schist, and marble; and 17 by various combinations of the above including, or excluding, Oligocene adamellite. Collectively, Precambrian W and X (?) lithologies account for 61 of the 79 stream sediment anomalies.

The correlation between anomalous stream sediment samples and water samples is most apparent in a comparison of either plates 2 and 3 or figures A-3 and B-3. Water anomalies 24-26, 28, 38, and 40-45 lack corresponding stream sediment anomalies, and stream sediment anomalies 63 and 67-74 lack corresponding hydrogeochemical anomalies. Finally, the lack of coincidence between stream sediment and water anomalies in the southwestern Raft River Mountains stems from the arbitrary definitions employed (U contents _ 85th percentile of the respective distributions). A single anomalous water, number 27, and two subanomalous waters coincide with the cluster of stream sediment anomalies, 37-37 (figs. A-3 and B-3 or plates 2-3).

The mean Uf, Ut, and Uf/Ut ratio and associated standard deviations of stream sediment anomalies in the Raft River, Grouse Creek, and Albion Ranges were calculated, but the results are of dubious statistical significance because of the small number of samples. It is noteworthy, however, that the higher values for the three variables are associated with anomalies in the Raft River Range, whereas somewhat lower values

for the three variables typify anomalies in the Grouse Creek and Albion Ranges. The only discernible difference between the western and eastern exposures of the autochthon relates to the effects of regional metamorphism. The Albion and Grouse Creek Ranges contain the most deformed and highest metamorphic grade exposures of the autochthon, whereas the Raft River Mountains contain the least deformed and lowest metamorphic grade exposures.

In summary, the strong statistical, areal, and lithologic correlations noted between Uf and Ut for the stream sediment anomalies, and the high coincidence of stream sediment and hydrogeochemical anomalies, are interpreted to owe their origins to the processes of mechanical and chemical weathering, erosion, and solution of uraniferous heavy minerals. Uraniferous minerals, notably monazite, allanite, samarskite, uranothorite (?), and zircon, as well as others possibly present, but as yet unreported, are known to occur as disseminations in Archean, Precambrian X (?), and Tertiary rocks (Compton, 1972, 1975; Todd, 1973; Bill Gallant, oral communication, 11/13/79). They represent either magmatic, detrital, syngenetic, or metamorphically segregated components of the rocks, depending on the lithology in question. Mechanical and chemical weathering liberates the uraniferous minerals to the drainage basins. Solution of uraniferous heavy minerals in the rocks themselves or of alluvial concentrations derived therefrom by spring and stream water probably accounts for the weakly uraniferous waters as well as the generally observed correspondence between stream sediment and hydrogeochemical anomalies.

Low Uf values and low Uf/Ut ratios probably reflect heavy mineral concentrations already leached of their soluble uranium or, as is more likely in light of available mineralogic data, the presence of resistate heavy minerals such as zircon and monazite which are little affected by treatment with a mixture of hot nitric-hydrofluoric acid. The high statistical and areal correlations of Uf and Ut, as well as the lognormal distribution of Uf/Ut, emphasize that uranium in the target lithologies resides in sparingly soluble minerals.

Uraniferous minerals suspected to be present in the Precambrian W and X (?) lithologies include allanite, monazite, zircon, samarskite, and possibly uranothorite (Todd, 1973; Compton, 1975, Bill Gallant, oral communication, 11/13/79). These uraniferous minerals, except for zircon and possibly monazite, are sparingly soluble and susceptible to treatment by a mixture of hot nitric-hydrofluoric acid. They likely account for most of the statistical, areal, and geochemical correlations noted between Uf, Ut, and geochemically related elements such as thorium, cerium, and yttrium. Acceptance of this interpretation, however, renders the presence of important uranium mineralization doubtful, because commercial areas typically contain highly soluble minerals such as uraninite, pitchblende, and coffinite rather than the resistate uraniferous minerals previously mentioned.

Finally, the magnitude of the Uf and Ut anomalies in both the stream sediments and rocks does not require uranium mineralization, but merely the presence of heavy minerals in which uranium can substitute for other geochemically similar elements, such as thorium and the rare

earths. This, too, is amply satisfied by the known occurrence and distribution of allanite, monazite, zircon, and, less commonly, samarskite and possibly uranothorite in the Precambrian W and X (?) lithologies. Collectively, the geochemical data support the preferred interpretation and argue against the possibility of important uranium mineralization in the Raft River area.

Variables Related to Uranium

Calculation of Pearson and Spearman correlation coefficients permitted determination of the variables that are related statistically to uranium (table B-II). Statistically significant correlations were obtained for Ut (neutron activation), boron, calcium, scandium, nickel, copper, lithium, zinc, yttrium, thorium, cerium, aluminum, sodium, beryllium, and strontium. Correlation coefficients for boron, calcium, and strontium are all negative (table B-II). The strongest correlation, between Uf and Ut (0.93), has already been discussed. The other correlation coefficients are equal to or less than 0.33, which renders them of questionable significance.

Cluster analysis of the correlation matrix facilitated recognition of groups of correlated variables (fig. B-I). The cluster analysis in no way alters the correlations and can be thought of as a convenient organization of the statistically significant correlations. Groups of correlated variables are isolated by a black line on the correlation

matrix (table B-II). Cluster and correlation analyses of variables are powerful tools in discerning, as well as interpreting, relationships between variables or groups of variables.

As previously noted, correlation and cluster analyses of variables result in a more complicated correlation matrix and dendrogram for stream sediment samples than for water samples. All of the statistically significant correlations, as well as the relationships between groups of correlated variables, are believed to signify common mineralogic and/or lithologic associations resulting from a variety of igneous, sedimentary, and/or metamorphic processes and not important uranium mineralization.

Boron and zirconium are highly correlated and comprise the second group of correlated variables in figure B-1. These elements are widely distributed but only in sparse amounts (tables C-I through C-VIII, appendix C). The areal geochemical plots for each show somewhat erratic distributions that correspond most closely with Elba Schist and Quartzite in the Raft River Range, Elba Quartzite and Upper Narrows Schist in the northern Albion Range, and Elba Quartzite and Conglomerate elsewhere. In addition, some scattered boron anomalies occur in association with Paleozoic rocks.

The distribution, lithologic correlation, and geochemical association of boron and zirconium are interpreted to be associated with a similar distribution of tourmaline and zircon in stream sediments derived from the erosion of quartzite, conglomerate, and adamellite. These two resistate heavy mineral silicates are known to occur in quartzite and

conglomerate (Compton, 1975), and zircon is a common accessory in the Archean adamellite gneiss (Todd, 1973).

A negative correlation between boron and uranium (Uf and Ut) mirrors the paucity of uranium in quartzite. Thus, stream sediments derived principally from erosion of quartzite are unlikely to contain much soluble uranium. This interpretation is reinforced by the paucity of boron anomalies in areas underlain largely by Archean and Oligocene adamellite whereas the opposite effect is noticeable in areas underlain by extensive exposures of quartzite. In contrast, the reverse of both situations is true for uranium (figs. B-3 and B-4).

Barium and potassium comprise the third group of highly correlated variables (fig. B-1). The areal geochemical plots of both are similar. That for potassium is included in Appendix B (fig. B-5). Comparison of figure B-5 and plate 1 reveals that abnormal concentrations of potassium correlate closely with the distribution of Archean and Oligocene adamellites and Precambrian X (?) schists. Barium and potassium anomalies in stream sediments probably indicate abnormal concentrations of feldspar derived from erosion of mostly adamellite and schists and, to a lesser extent, the upper quartzite member of the Elba which contains abundant microcline. The lack of any correlation between barium, potassium, and uranium, whose distributions parallel each other in rocks and waters, stems from differences in the specific gravity of feldspar and uraniferous heavy minerals. Thus, anomalies due to the feldspar are not likely to include anomalies due to the uranium. Accordingly, no statistical correlation exists despite derivation from the same bedrock lithologies.

The fourth group of correlated variables includes calcium and magnesium (fig. B-1). The areal distributions of both are very similar. Concentrations of calcium and magnesium in stream sediments show a close relationship to bedrock lithology. Anomalous contents coincide with Paleozoic carbonates and mafic igneous rocks, both of which are rich in these elements. Intermediate contents relate to Archean and Oligocene adamellites and Precambrian W and X (?) schists. Very low values coincide with extensive exposures of quartzite. Thus, areal, lithologic, and geochemical correlations of calcium and magnesium reflect their similar chemistry and distribution principally as carbonate ferromagnesian minerals and calcium plagioclase. The statistically significant but negative correlations with uranium are readily explained by the paucity of uranium in carbonate and mafic rocks, the principal sources of calcium and magnesium in the study area.

The largest group of correlated variables includes scandium, vanadium, cobalt, chronium, nickel, and copper (fig. B-1). All exhibit strikingly similar areal distributions, and lithologic and geochemical correlations of the variables in this group mirror the distribution of mafic rocks in Precambrian W and X (?) units. Thus,stream sediment anomalies of these six variables indicate abnormal concentrations of heavy and ferromagnesian minerals derived from erosion of nearby amphibolites and mafic schists. The statistically significant positive correlations between scandium, nickel, copper, and uranium probably reflect comparable quantities of associated heavy minerals. Silicic and

mafic Precambrian W and X (?) rocks, which are invariably present in the same drainages, account for the observed relationship between these variables.

Lithium and zinc comprise another group of correlated variables. Areal distributions and lithologic correlations mirror the occurrence of late stage igneous differentiates, such as pegmatites and mineralized areas, and early stage metamorphic segregations in schists. A number of zinc anomalies correlate with water collected from galvanized troughs and pipes. Thus, the predominant lithologies involve remobilized Archean adamellite, pegmatites, and aplites in Archean and Oligocene adamellites, and Precambrian W and X (?) schists containing metamorphic segregations. Correlation with uranium indicates a similar source for uraniferous minerals.

Phosphorus and yttrium form a group of correlated variables. Distribution plots of these two variables are similar. Anomalies exhibit close correspondence with Archean and Precambrian X (?) schists and Paleozoic carbonates. Intermediate values relate to exposures of quartzite. The areal, lithologic, and geochemical correlations are interpreted to signify the common occurrence and similar distribution of apatite and monazite, two resistate heavy minerals known to occur in Precambrian and Tertiary adamellites (Todd, 1973) as well as in the Elba Quartzite (Bill Gallant, oral communication, 11/13/79). In addition, Compton and others (1977) obtained apatite from Archean adamellite and Pogonip marble for fission track dating. Thus, stream sediment anomalies

of phosphorus and yttrium likely reflect abnormal concentrations of apatite and monazite derived from erosion of nearby rocks containing these mineral phases. Noteworthy is the lack of correlation between uranium and phosphorus and between thorium and phosphorus. Perhaps this merely reflects the paucity of uranium and thorium in apatite (Compton and others, 1977), as well as an impoverished source of these two elements in Paleozoic carbonates and in all quartzites. It also suggests that another mineral, probably allanite, accounts for most of the uranium (Uf) and thorium.

Manganese and titanium correlate and comprise still another group on the dendrogram (fig. B-1). Also included is total gamma, but no significance is attached to this variable relative to stream sediments because the data are quite sparse. Thus, the calculated correlation coefficients are of dubious significance. The areal distributions of manganese and titanium, which are not included in appendix B, correspond closely to extensive outcrops of Upper Narrows Schist and, to a lesser extent, mafic igneous rocks such as amphibolite. Intermediate values coincide with quartzites. Thus, anomalies of manganese and titanium in stream sediments probably signify abnormal concentrations of ilmenite, rutile, and sphene derived from erosion of mafic schists, quartzites, and amphibolites. Lack of correlation with uranium is to be expected since mafic rocks and quartzites constitute poor sources of uranium.

Thorium and cerium comprise a group of correlated variables (fig. B-1).

The areal distributions of both elements are similar. Comparison of figure B-7 and plate 1 reveals a strong coincidence between thorium anomalies and areas underlain by extensive exposures of Archean adamellite gneiss. Intermediate values are rather widely distributed and are associated with Precambrian X (?) schists and quartzites. These latter lithologies also constitute a large reservoir of thorium and cerium-related elements. Moreover, comparison of figures B-3 and B-4 with figure B-7 indicates a striking parallel between the areal distributions of Uf, Ut, and thorium. The thorium-cerium association probably indicates an association resulting from abnormal concentrations of monazite, allanite, and samarskite in stream sediments originating from erosion of mostly Precambrian W and X (?) lithologies, and the contact zones between Archean and Oligocene adamellites (Todd, 1973).

The statistical and areal correlations of thorium, cerium, and uranium, therefore, is to be expected and relates to similarities in geochemistry mineralogy, and lithology in the study area. Accordingly, most and probably all of the uranium in the stream sediment anomalies derives from concentrations of resistate uraniferous heavy minerals in which uranium is present as a minor substitution rather than a major component. Allanite, monazite, zircon, and samarskite, listed in decreasing order of importance, are the likely residence sites of uranium. These minerals are also the main sources of thorium, cerium, and yttrium. In this interpretation, the uranium anomalies in water, stream sediments, and rocks are unrelated to important uranium

mineralization. Rather, they mirror the distribution of uranium and geochemically-related elements in bedrock sources within the study area as well as the various geologic processes whereby mobilization occurs in the supergene environment. This interpretation derives support from the observed strong correlation between bedrock lithology and uranium anomalies and the relatively small magnitude of the anomalies irrespective of sample type.

Sodium and aluminum are also a group of correlated variables, grouped together on the dendrogram (fig. B-1). Their distribution and lithologic correlations are strikingly similar and are closely related to the large exposures of Archean adamellite gneiss within and around the cores of the gneiss domes in the Grouse Creek and Albion Ranges (fig. B-8 and plate 1). The strong areal, lithologic, and geochemical associations of sodium and aluminum indicate major occurrences of sodium feldspar (albite and oligoclase) in Archean adamellite gneiss. Thus, stream sediment anomalies of sodium and/or aluminum merely reflect the occurrence and distribution of sodium feldspar which derives mainly but not exclusively from erosion of Archean adamellite gneiss. Adamellite in the mantled gneiss domes was subjected to sodium metasomatism in proximity to intrusions of Tertiary adamellite, an observation first noted by Todd (1973) in her petrographic study of the Archean and Oligocene adamellites in the central Grouse Creek Mountains. The geochemical plots of sodium and aluminum demonstrate that sodium metasomatism of the Archean adamellite gneiss by Oligocene intrusions is not limited to the latter area, but also characterizes the Moulton, City of Rocks,

Almo, and Mount Independence gneiss domes in the Albion Range (plate 1).

The effects of sodium metasomatism clearly exert the the greatest control on the distribution of the elements sodium and aluminum. A similar but less pronounced effect is suggested for thorium, based on a similar, but less extensive distribution (fig. B-7 and C-7). Apparently uranium was not affected by the process, except possibly in the central Grouse Creek Mountains, because the effects thereof are not obviously expressed in the distributions of Uf or Ut, even though uranium exhibits statistically significant (but low) correlation coefficients with sodium and aluminum. It should be noted, however, that deep erosion in both the City of Rocks and Almo mantled gneiss domes may have eliminated the effects of the process in these two areas by removal of the altered envelope. In contrast, insufficient erosion of Big Bertha and the Raft River Range domes probably accounts for the lack of expression in those areas, assuming, of course, both are domed by and cored with Tertiary intrusions at depth.

Interestingly, sodium metasomatism is also known to be a common type of alteration accompanying uranium mineralization in or near plutonic igneous rocks (Mathews, 1978). Thus, coincidence of geochemical anomalies (plates 2-4), airborne radiation anomalies (plate 4), and sodium metasomatism of Archean adamellite by Oligocene adamellite (fig. B-8 and plate 1) support the possibility of uranium mineralization in the central Grouse Creek Mountains. Although this possibility is doubtful, it can only be verified or refuted by additional field work.

Beryllium and niobium form the last group of two correlated variables on the dendrogram for stream sediment samples (fig. B-1). They exhibit similar areal distributions and lithologic correlations (fig. B-9). Anomalies coincide with areas underlain by either pegmatite, aplite, or quartz veins in Archean and Tertiary adamellites, or metamorphic segregations in Precambrian X (?) schists. The areal, lithologic, and geochemical associations of beryllium and niobium are interpreted to signify the similar occurrence and distribution of beryl, or a beryllium-bearing heavy mineral, and a heavy mineral of niobium and tantalum, probably columbite and samarskite, both of which are known to occur in trace amounts in Tertiary adamellite and Archean schist (Anderson, 1931; Bill Gallant, oral communication, 11/13/79). The correlation between uranium and beryllium mirrors the similar occurrences and distributions of these two elements. The lack of correlation between niobium and uranium, however, probably stems from the paucity of columbite and samarskite in these rocks.

Strontium is isolated on the dendrogram, but it correlates well, both statistically and areally, with barium and calcium (table B-II). The strontium geochemical plot is also similar to that of calcium. Anomalous strontium values correlate with expsoures of Paleozoic carbonates and Tertiary adamellite. Intermediate values correspond to Archean adamellite and Precambrian X (?) schists. All four lithologies contain abundant strontium. Stream sediment anomalies of strontium relate mostly to erosion of nearby carbonate rocks and, to a lesser extent, pegmatites and aplites in Tertiary adamellite in the Albion

Range. The negative and low statistical correlation between strontium and uranium probably stems from the strong influence of Paleozoic carbonates on the occurrence and distribution of strontium. Carbonates, in general, are poor sources of uranium.

Summary of Stream Sediment Data

Analysis of the seventy-nine (79) anomalous stream sediment samples indicates the following conclusions:

1). These samples exhibit strong lithologic preferences, specifically for the adamellite gneiss of the Green Creek Complex and the lithologies included in the Precambrian W and X (?) age rocks.

2). These host rocks are most common in the Grouse Creek and Raft River Mountains, but do occur in the Albion Range.

3). The anomalous stream sediment sample sites coincide with many of the anomalous water sample sites (plates 2 and 3).

4). Sodium metasomatism of Archean adamellite caused by nearby intrusion of Oligocene adamellite affected concentrations of sodium, aluminum, and to some extent, thorium.

Statistically significant Pearson and Spearman correlations

were obtained for a number of variables. Their correlations are attributed to mineralogic associations which are found in specific host rocks.

The magnitude of the stream sediment anomalies for uranium are low and range from 7.2 to 103 ppm Uf and Ut. Of a total of 79 anomalies only 23 exceed 30 ppm Uf and Ut and 56 fall in the range 7.2 to 30 ppm Uf and Ut. Deviations from lognormality are pronounced only for Uf and Ut values greater than about 5 and 7 ppm, respectively (fig. B-2). The ratio Uf/Ut exhibits a strong lognormal distribution. Exceptions are few and include samples with low Uf contents which signify the presence of uranium in mineral phases generally resistant to treatment by a mixture of hot nitric-hydrofluoric acid. In these instances, the uranium is likely present in small amounts in minerals like zircon and monazite. The high correlation coefficient of 0.93 for Uf and Ut also indicates that this is the rule rather than the exception. Thus, statistical, areal, lithologic, and geochemical associations of Uf and Ut closely parallel each other (figs. B-3 and B-4) and are readily accounted for by the presence of known uraniferous heavy minerals in which uranium occurs as a minor rather than a major component. If these refractory minerals are interpreted to reflect uranium mineralization, it is mineralization of dubious significance, since ore bodies typically contain soluble rather than insoluble uranium minerals.

Variables statistically correlated with Uf, as well as generally with Ut, include boron, calcium, scandium, nickel, copper, lithium, zinc, yttrium, thorium, cerium, aluminum, sodium, beryllium, and strontium (table B-II). Except for a Uf and Ut correlation of 0.93,

all other correlation coefficients are equal to or less than 0.33. Total gamma count correlates with a number of variables including Uf and Ut, but none is considered significant because of the small number of radiation measurements (37) related to steam sediment samples.

Cluster analysis of the correlation matrix results in a more complex dendrogram for stream sediment samples than for water samples. Nonetheless, the various groups of correlated variables are readily explained by common mineralogic, lithologic, and/or geochemical associations, none of which appear to relate to uranium mineralization. All groups of correlated variables reflect common rock-forming or accessory mineral assemblages. The strong lithologic correlations exhibited by many variables merely verifies the principal sources and residences as determined independently by analysis of rock samples.

The stream sediment anomalies for uranium are interpreted to relate to concentrations of heavy minerals in which uranium substituted for geochemically similar elements such as thorium, zirconium, yttrium, cerium, and so forth. The most likely uraniferous phases include monazite, allanite, samarskite, zircon, and possibly uranothorite (?), all of which have been reported to occur here (Compton, 1975; Todd, 1973; Anderson; 1931; Bill Gallant, oral communicaion, 11/13/79). Other uraniferous phases may be present but have not been identified and reported. These uraniferous minerals occur mainly as sparse disseminations in Precambrian W and X (?) rocks and in local magmatic and metamorphic segregations in Tertiary plutons and Precambrian X (?) schists, respectively. Mechanical and chemical weathering, erosion,

and subsequent deposition of the detritus of these sparsely uraniferous rocks result in the formation of heavy mineral concentrations in the present drainage system. This interpretation derives support from the strong statistical, areal, geochemical, and lithologic correlations previously described for Uf and Ut, the coincidence of weak hydrogeochemical anomalies which arise from solution of these sparingly soluble uraniferous phases, the generally low magnitude of most of the stream sediment anomalies and the statistically significant but generally low correlation coefficients for Uf and other variables or groups of correlated variables whose occurrence and distribution are readily accounted for in common geochemical, mineralogic, and lithologic associations.

Some stream sediment anomalies, in particular those associated exclusively with Archean adamellite gneiss in the central Grouse Creek Mountains, may reflect uranium mineralization of dubious importance either in veins or as a dissemination in the sodium metasomatized gneiss. This possibility can neither be proved nor refuted with existing data, but it is supported by the coincidence of hydrogeochemical, stream sediment, and airborne radiation anomalies and sodium metasomatism of the Archean adamellite gneiss. Thus, as a precautionary measure, follow-up sampling, radiation measurements, and field observations in the area are justified and recommended to assess this remote possibility. In addition, several other areas probably warrant field checks, notably the Left Hand Fork of Johnson Creek, the Upper Narrows, the Cedar Hills, and the Ashbrook and Century Hollow (Park Valley) mining districts. Uranium mineralization in all of these areas is considered to be a remote possibility.

Rock Samples

A total of 264 rock samples were collected from the study area. Sampling sites and anomalous samples are shown on plate 4, which is at the same scale (1:125,000) as the other maps (plates 1-3). Areas on plate 4 for which sample coverage is sparse or entirely lacking are either underlain by rocks having no potential for the type of uranium deposits sought or else they correspond to areas of private land ownership and limited access. Sample coverage otherwise is considered adequate.

Thirty-one variables were measured and are listed in the summary statistics in table C-I through C-VII. The corresponding data are presented in table C-IX. Statistically significant correlations were obtained for most variables and are shown in table C-VIII. The results of cluster analysis of the correlation matrix for rock variables are graphically illustrated in figure C-1. Logprobability, logfrequency, percentile, and areal distribution plots of the more important variables are included in figures C-2 through C-15.

Preliminary analysis of the rock sample data prompted grouping of certain stratigraphic units because of nearly identical compositions. The groups formed are those shown in the summary statistics and percentile plots in tables C-II through C-VIII, and figure C-2 and C-3, respectively. Grouping accounts for the multiplicity of geologic codes, an explanation of which is provided in table IV. Group 1 consists of a single lithostratigraphic unit, the quartzite of Clarks Basin. Group

2 includes the Yost and Elba Quartzites which are practically indistinguisable chemically. The conglomerate member of the Elba Quartzite represents Group 3. Precambrian X (?) schists, notably the Elba, Upper Narrows, and Stevens Spring, comprise group 4. Archean adamellite and adamellite gneiss are grouped together, as are all of the Archean schists, to form the last two groups. Thus, each group has characteristic stratigraphic, as well as lithologic, attributes.

Examination of the summary statistics for rock samples reveals that all of the variables, except silver and molybdenum, occur in concentrations above the detection limit of their respective analytical method (table C-I, appendix C and table VI). The number of measured boron, cobalt, and niobium values is considerably less than the other 26 variables. Thus, the corresponding data for these three elements may or may not be statistically significant. Correlation and cluster analyses of the variables for rock samples yield a correlation matrix and dendrogram similar in many respects to those of stream sediment samples (compare tables B-II and C-VIII and figures B-1 and C-1).

Logprobability and logfrequency plots of concentrations of the measured variables for rock samples generally exhibit statistical distributions which deviate significantly from lognormality. Exceptions are few and include Uf, Uf/Ut, phosphorus, and thorium. This is the opposite of that noted for water and stream sediment samples, where lognormal distributions were the rule rather than the exception. Deviations from lognormality for variables in rock samples range from weak to strong. They stem from the inclusion of at least six different groups or

subpopulations of rocks into a single population for statistical consideration. Insofar as could be determined, none of the deviations relates to uranium mineralization. Analysis of a few subpopulations (individual groups) suggests that each possesses approximately lognormal distributions. This is also indicated by the character of the logfrequency plots. A few of these are included in appendix C.

Consideration of the various statistical data permits recognition of 25 anomalous uranium rock samples. Geochemical anomalies are arbitrarily defined to be rock samples in which both the Uf and Ut concentrations equal or exceed the 85th percentile of their respective logprobability distributions. This corresponds to 2.88 ppm and 5.10 ppm for Uf and Ut, respectively, each of which is equivalent to one standard deviation above the mean. This dual requirement results in slightly fewer anomalies (plate 4) than are indicated on the respective geochemical plots for Uf and Ut (figs. C-4 and C-5, app. C).

Uranium

Summary statistics for all rock samples, as well as for individual groups of rock samples, are presented in tables C-I through C-VIII, app. C. Logprobability, logfrequency, and percentile plots for Uf and Ut are shown in figures C-2 and C-3, app. C. The statistical data for Uf and Ut in these tables and figures indicated that the target lithologies contain, on the average, only clarke amounts of uranium. Precambrian X (?) conglomerate

and schists and Precambrian W adamellite and schists contain slightly higher amounts than the quartzites. Moreover, both the Uf and Uf/Ut data for Precambrian W and X (?) schists indicate that a higher proportion of the uranium in these rocks resides in minerals which are not particularly susceptible to leaching by a mixture of hot nitric-hydrofluoric acid. In general, however, this is the exception rather than the rule, because Uf and Ut for both rocks and stream sediments exhibit strong statistical, areal, and geochemical correlations. Thus, uranium exists in these rocks in mineral phases that are at least sparingly to moderately soluble, as is evidenced by the 52 hydrogeochemical anomalies (plate 2).

A comparison of either the median soluble uranium or median total uranium content with the median thorium content of the Archean adamellite suggests that either some uranium has been mobilized out of this rock or else it was originally impoverished in uranium (tables C-VI and figs. C-2 , C-3, and C-6). The former interpretation is preferred over the latter in light of the conspicuous areal correspondence observed between geochemical anomalies and the Green Creek Complex.

Comparison of the logprobability plots for Uf and Ut reveals that the Ut deviates from lognormality more than the Uf (figs. C-2 and C-3, app. C). This probably reflects the different statistical distribution of Ut for each of the subpopulations or groups of rocks. The nearly lognormal distribution of the ratio Uf/Ut and the statistically significant, high, positive correlation coefficient of 0.89 suggests Uf and Ut are genetically related (table C-8). This was also the case with stream sediment samples. Additional evidence supporting this

inferred genetic relationship is reflected in their similar geochemical distributions.

The areal distributions of Uf and Ut concentrations in rock samples are shown in figures C-4 and C-5, app. C, wherein uranium concentrations are depicted graphically by standard symbols of the Canadian Geological Survey (Arendt and others, 1979). The distribution patterns of both variables are nearly identical. Moreover, the patterns are reminiscent of those for water and stream sediment samples (figs. A-3, app. A; B-3, and B-4, app. B), although they are not as striking because of fewer samples and, therefore, fewer anomalies. The strong geographic coincidence of water, stream sediment, and rock anomalies stems from the proximity of sampling sites and the profound influence of bedrock lithology on the uranium contents of the three sampling media.

Out of 25 uranium anomalies in rock samples, five occur in the Grouse Creek Mountains, one in the Dove Creek Mountains, seven in the Raft River Range, and 12 in the Albion Range (plate 4). With respect to bedrock lithology, one each relates to trondhjemite and tuff, three to schist, four to adamellite gneiss, seven to adamellite, four to quartzite, and five to conglomerate (table IX). Stratigraphic distribution of the anomalies parallels that noted for waters and stream sediments with 10 occurring in rocks of the Green Creek Complex, 10 in Precambrian X (?) rocks, one each in Tertiary adamellite and tuff, and three in the contact zones of Oligocene and Archean adamellites (table IX).

Relatively speaking, all of the anomalies are low amplitude, ranging from 2.14 ppm Uf to a maximum of 27 ppm Ut (table IX). The ratio

Uf/Ut ranges from 0.50 to 1.11. Values of Uf/Ut greater than unity stem from analytical errors, that is, a high Uf and a corresponding low Ut for the same sample. Intermediate to high Uf/Ut values characterize the anomalies and mirror the statistical distribution of this variable for the total sample population. This indicates that the uranium resides in sparingly to moderately soluble minerals. This was also the case for stream sediment anomalies. Both observations are compatible with the interpretation that the uranium anomalies in both sampling media relate to resistate uraniferous minerals in which uranium occurs in association with, and substitutes for geochemically similar elements like thorium, cerium, yittrium, and zirconium. This interpretation is compatible with the known occurrence and distribution of uraniferous resistate heavy minerals in the study area, notably allanite, monazite, zircon, samarskite, and possibly uranothorite. The first three accessory minerals are the most abundant and widely distributed in Precambrian W and X (?) rocks, according to Todd (1973) and Compton (1975). Samarskite is known to occur in igneous and metamorphic segregations in Oligocene adamellite and Archean schist, respectively (Bill Gallant, oral communication, 11/13/79).

Variables Related to Uranium

Calculation of Pearson and Spearman correlation coefficients permitted determination of the variables statistically related to uranium (table C-VIII, app. C). Statistically significant and positive

correlations were obtained for all variables except silver, boron, molybdenum, niobium, and zirconium. These five variables had small sample populations and were excluded from the correlation analysis. The strongest correlations were between Uf, Ut, thorium, cerium, aluminum, potassium, and yttrium (table C-VIII, app. C). The other correlations are significantly lower and are of dubious importance with respect to uranium mineralization.

Cluster analysis of the correlation matrix resulted in groupings of the correlated variables shown in figure C-1. These groups are isolated by a black line on the correlation matrix in table C-VIII, app. C. Cluster and correlation analyses permit recognition and interpretation of the relationships between variables or groups of variables. The complexity of the correlation matrix and dendrogram for rock samples is quite similar to that of stream sediment samples (table B-II and fig. B-1, app. B). Striking parallels exist between a number of the variables for both stream sediment and rock sampling media. This is a logical result of the weathering of sediments.

All of the statistical, areal, and geochemical correlations deduced from study of the rock sample data are interpreted to signify common mineralogic and/or lithologic associations resulting from a variety of igneous, sedimentary, and/or metamorphic processes. None appears to relate to important uranium mineralization, although this possibility is not precluded by the data.

Thorium and cerium are highly correlated with each other as well as with Uf and Ut (table C-VIII, app. C). The areal distributions of

both elements are quite similar and both exhibit striking parallels to that of Uf and Ut. Only the statistical and areal data for thorium are included in appendix C (figs. C-6 and C-7). The statistical and areal correlations of thorium and cerium are interpreted to reflect mainly the occurrence and distribution of a resistate uraniferous heavy mineral namely, monazite. This interpretation likewise accounts for the statistical and areal correlations observed between these two variables and uranium. Additional evidence in support of this interpretation derives from the high correlations between phosphorus, yttrium, uranium, thorium, and cerium (table C-VIII).

Cluster analysis of calcium and sodium largely reflects their similar geochemistry. In the Raft River area this correlation derives from, or at least is accentuated by, sodium metasomatism of the Archean adamellite gneiss wherever it is intruded by Oligocene adamellite. This occurs in the central Grouse Creek Mountains, Moulton, City of Rocks, and Almo, Mount Independence, and Raft River mantled gneiss domes (plate 1). In these areas calcic oligoclase has been altered to sodic oligoclase and albite. This is clearly indicated by the areal distributions of sodium and aluminum in stream sediments (fig. B-8), but it is not indicated by any variable in the rock samples, probably because of sparse sample coverage. Sodium metasomatism may exert some minor influence on the distribution of thorium (fig. B-7), but none is evident for Uf or Ut (figs. B-3, B-4, C-4, C-5). Thus, the statistical, areal, and geochemical correlations of calcium and sodium mirror mineralogic, lithologic, and metasomatic associations. The largest reservoir of these minerals is adamellite and schist. Correlations between calcium, sodium, and uranium, therefore, are understandable since the

adamellite and schists are also major sources of uranium, thorium, cerium, yttrium, and zirconium. Adamellite is also an important source of allanite, zircon, and monazite, in which all of these elements occur as minor or major components (Todd, 1973).

Aluminum, potassium, barium, and strontium form a group of highly correlated variables (table C-VIII and fig. C-1). The areal distribution of these elements is similar. This group is interpreted to reflect the occurrence and distribution of potash feldspar, and to a lesser extent, muscovite and biotite, all of which are abundant and widely distributed in Precambrian W and X (?) lithologies. Correlation between uranium and these variables relates to the common association and similar distribution of essential and accessory minerals. The largest reservoir of these minerals is Precambrian W and X (?) rocks, specifically adamellite, adamellite gneiss, trondhjemite, pegmatite, and schist.

Phosphorus and yttrium are highly correlated and grouped together in the cluster analysis (fig. C-1). The most plausible explanation for this relationship is the common occurrence and similar distribution of monazite and apatite. Both minerals are present and widely distributed in sparse amounts in adamellite, adamellite gneiss, and quartzites. They are probably also present in the schist, trondhjemite, and pegmatite which have received less petrographic study. Apatite also occurs in some Paleozoic carbonates (Compton and others, 1977). An explanation of the correlation between uranium and these two variables has already been provided in the discussion of thorium and cerium.

Lithium, zinc, and manganese are highly correlated (fig. C-1). This group of three variables mirrors a lithologic association in Precambrian W and X (?) schists, which comprise the main source of these elements. Lesser but important amounts of these elements also reside in adamellite. Intermediate correlation coefficients between uranium and these three elements are of dubious significance but apparently bear no relationship to uranium mineralization. However, the correlations may reflect original syngenetic accumulation of these metals in marine muds.

The next group of highly correlated variables includes iron, titanium, scandium, vanadium, and magnesium. In the absence of abundant and widespread mafic rocks, this group is interpreted to signify similar geochemical and mineralogic associations. Included here is magnetite, ilmenite, rutile, sphene, and, to a lesser extent, probably epidote and amphibole. Collectively, these minerals contain the elements of this group and exhibit similar occurrences and widespread distribution in the target lithologies. All are reported to occur in various Precambrian W and X (?) lithologies (Todd, 1973; Compton, 1972, 1975; Compton and others, 1977; and Miller, 1978). No special significance is attached to the correlations between uranium and the elements of this group. They may reflect the similar occurrence and distribution of accessory minerals containing these elements. Mafic schists and adamellite comprise the largest reservoir of iron, titanium, scandium, vanadium, and magnesium. It is therefore understandable why some, albeit low, correlation exists between uranium and the elements of this group.

Chromium, nickel, and copper form a group of three related variables. All three exhibit similar areal distributions. Since just a few samples of Archean amphibolite were analyzed, this group reflects a lithologic

association, notably mafic schists which occur in Precambrian W and X (?) units (Compton, 1972, 1975). The low but statistically significant and positive correlation between uranium and these three variables mirrors the paucity of uranium in mafic lithologies.

Inasmuch as the most reliable radiometric data were obtained in connection with rock sampling, a few comments concerning equivalent potassium, uranium, and thorium (KUT) are appropriate at this point. The subject of radioactivity was discussed in an earlier section of this report and will not be addressed here. Statistical data for radiometrically equivalent uranium, thorium, and potassium contents are shown in figures C-8, C-9, and C-10, respectively. Comparison of the radiometrically equivalent and corresponding chemical data for each of the three variables reveals marked similarities with respect to their statistical distributions and concentration ranges. This emphasizes the utility and effectiveness of a spectrometer to differentiate between and measure the concentrations of the various radio-elements during field reconnaissance.

Summary of Rock Data

Analysis of 264 rock samples, collected mostly from target units in the Raft River area, resulted in recognition of 25 uranium anomalies of Uf and Ut (figs. C-4, C-5, and plate 4). Like hydrogeochemical and stream sediment anomalies, the uranium anomalies in rocks exhibit a strong lithologic and stratigraphic preference. Also noteworthy is the near coincidence of uranium anomalies in water, stream sediment, and rock samples. This stems from the proximity of sampling sites as well as the pronounced influence of lithostratigraphic units on the uranium contents of all three sampling media.

In general, the uranium anomalies in rocks are of low magnitude, ranging from the arbitrary lower limit of the 85th percentile of the Uf and Ut concentration distributions up to a maximum of 27 ppm Ut (table IX). Of the 25 uranium anomalies, only three exhibit Uf and Ut values greater than 10 ppm. For the most part, anomalies are associated with the more radioactive and uraniferous lithostratigraphic units. As compared to rocks in general, however, target lithologies in the Raft River area are not abnormally radioactive nor unusually uraniferous, containing, on the average, only clarke amounts of uranium (tables C-I through C-VIII, app C). Radiometrically equivalent uranium, thorium, and potassium contents measured in the field with a four-channel spectrometer (GAD-6) are quite comparable to their corresponding chemically determined contents (figs. C-8 through C-10 and C-12 through C-14).

Correlation and cluster analyses of measured variables in rocks yield a complex correlation matrix and dendrogram similar in many respects to those obtained for stream sediments. Most variables correlate with uranium, but only Ut, thorium, cerium, aluminum, potassium, and yttrium exhibit strong correlations (greater than 0.59; table C-VIII). Of these, Uf was by far the highest (0.89). This relationship also prevails in the case of stream sediments. High Uf contents suggest uranium resides in sparingly to moderately soluble minerals. Within the study area, allanite, monazite, zircon, samarskite, and possibly uranothorite have been identified and reported in Precambrian W and X (?) rocks (Todd, 1973; Compton, 1975, Bill Gallant, oral communication, 11/13/79).

All of the statistical, areal, and geochemical correlations deduced from a study of the rock sample data are interpreted to signify common mineralogic and/or lithologic associations resulting from a variety of igneous, sedimentary, and/or metamorphic processes. None appears related to significant uranium mineralization, although this possibility is not precluded by the data. Collectively, the geochemical data are compatible with the interpretation that the uranium anomalies relate to uraniferous resistate heavy minerals which are disseminated in various rocks as original magmatic, detrital, or metamorphically segregated components. The magnitude of the anomalies, as well as the relationships between Uf and Ut and geochemically related variables, is compatible with the residence of uranium in resistate heavy minerals, where it occurs in association with and substitutes for geochemically similar elements like thorium, cerium, yttrium, and zirconium. The known uraniferous resistate heavy minerals, notably allanite, monazite, zircon, and samarskite, amply satisfy this requirement. While the possibility of uranium mineralization in certain areas can neither be substantiated nor refuted with existing data, it is believed to be only a remote possibility.

URANIUM POTENTIAL OF TARGET LITHOLOGIES

Introduction

Uranium deposits in quartz-pebble conglomerates of late Archean and early Proterozoic age account for 17 percent of non-communist world uranium reserves available at $30 per pound or less (Chenoweth, 1977). Important deposits occur in the Witwatersrand area, South Africa, and in the Elliot Lake-Blind River region, Ontario, although they are known at a number of other localities as well (fig. 1). Uranium deposits in these rocks represent large, intermediate grade, low-cost reserves which are amenable to large-scale underground mining operations. Accordingly, they have been the object of intensive exploration efforts as well as the subject of numerous publications.

Houston and Karlstrom (1950) recently conducted an in-depth review of the literature pertaining to Proterozoic quartz-pebble conglomerate uranium deposits and discussed in some detail their various attributes. Table VII summarizes the various recognition-favorability criteria of these deposits. Thirteen major variables are shown. In general, target lithostratigraphic units in the Raft River area possess attributes which compare favorably with 10 of 13 parameters listed. With respect to certain key variables or attributes of the exploration model, however, the target units are either lacking or recognition is precluded by the effects of deformation and regional metamorphism.

Available data suggest that the possibility of important uranium mineralization is highly unlikely in any of the units studied. Lateral

Tectonic Setting:	On or peripheral to Archean shield, craton, or adjoining miogeosyncline.
Source Rock and Age:	Archean granitic terrains with anomalous K, U, and Th contents, and Archean Greenstone belts (pyrite & gold).
Climate:	Frigid (?) cold, temperate.
Weathering:	Dominantly mechanical.
Atmosphere:	Non-oxidizing with respect to uraninite and pyrite (pre-2000-2200 M.Y.).
Host Rock Age:	Late Archean to early Proterozoic (2800-2000 M.Y.) most favorable; Maximum age related to crustal evolution; minimum age related to atmospheric evolution.
Lithology:	Oligomictic, pyritic, quartz-pebble conglomerates and interbedded arkosic to quartzose sandstone; clasts composed of quartz, chert, quartzite, granite, and schist, matrix is pebble supported and composed of quartz, sericite, pyrite, stable heavy mineral oxides; pebbles comprise up to 80% of rock mass; Drab colors dominant-gray, green, white, buff, or pink (due to feldspar).
Depositional Environment:	Mainly braided stream, fluvial-lacustrine, marginal marine, and possibly sandhur (glacial outwash plain).
Sedimentary Structures:	Fining upward sequences, ripple marks, trough cross-bedding, pebble imbrication; sedimentary cycles; unconformity-regional or local; submature to mature textures (sorting, rounding, matrix); and immature to mature composition.
Geometry:	Stratiform, lenticular; commonly coalesced or stacked (3-100 feet) areally extensive sheets (up to 10,000 feet).
Stratigraphy:	Commonly overlie or occur short distance above profound unconformity; usually found below banded iron formations; commonly associated with paraconglomerates, quartzites, phyllites, slates, stromatolitic limestones, and pillow basalts of shallow water marine or continental environments; cyclic stratigraphy and lithologies common.
Mineralogy:	Uranium (0.03-0.15% U_3O_8) as uraninite, brannerite, uranothorite, and coffinite; pyrite (5-25%) principal heavy mineral and sulfide; wide variety of associated heavy mineral oxides and silicates, although magnetite conspicuously absent (?); thorium as monazite, uranothorite, thorite, and zenotime; thucholite as thin seams, mats, partings, and beads.
Metamorphism:	Most are greenschist facies; some amphibolite facies known; higher grades probably favor mobilization of uranium.

Table VII

RECOGNITION/FAVORABILITY CRITERIA FOR PROTEROZOIC QUARTZ - PEBBLE CONGLOMERATE URANIUM DEPOSITS

(from Jones (1978) and Houston (1979))

equivalents of some of these units, which are unaffected by severe metamorphic deformation, may possess some potential to host these types of uranium deposits. Some recognition-favorability criteria are discussed in more detail in the following section.

Recognition-Favorability Criteria

The Raft River area comprises the westernmost exposures of the Wyoming Precambrian Province (fig. 4). The latter area is a geochronologic province defined by rocks dated at more than 2.5 b.y. old and possessing lithologic and other attributes which compare favorably with those in the not far distant Slave and Superior Provinces of Canada (Houston and Karlstrom, 1980). The tectonic setting of the study area, therefore, coincides with the perimeter of an Archean shield or craton. Obviously, this may indicate, but is not proof of, uranium mineralization according to the model (table VII).

The Precambrian X (?) target units, notably the Elba and Yost Quartzite, were derived from an Archean terrane similar in most respects to that comprising the Green Creek Complex. Their mineralogic and lithologic attributes reflect the deviation from igneous and/or metamorphic crystalline rocks. The quartz-rich character of the Precambrian X (?) succession, as well as the ubiquitous quartzite pebbles and cobbles in the conglomerate member of the Elba Quartzite, indicate that their origin included sedimentary rocks. Moreover, the Elba

Quartzite unconformably overlies the basement complex throughout the study area (plate 1). Amphibolites, which represent metamorphosed dikes, sills, and flows of mafic composition, and pegmatite, trondhjemite, adamellite, schist, and quartzite are all common lithologies in the Green Creek Complex. Adamellite is the most abundant and widespread rock. The presence and distribution of pyrite and gold in the mafic rocks are unknown because these rocks were not studied or sampled in detail as they typically constitute poor sources and host of uranium. Whereas the provenance and age fit the model, these variables only indicate potential host rocks for uranium mineralization.

Less is known about the provenance of the Precambrian W metasedimentary rocks, which are the oldest exposed rocks. No favorable host lithologies were observed in Archean rocks. Schist is the predominant lithology, but some feldspathic and arkosic quartzite, and pebbly and cobbly mudstone occur in Jim and Rice Canyons in the Raft River Mountains. Locally metasedimentary rocks may be abundant, but areally they represent a minor lithology of the Green Creek Complex. Mineralogic, lithologic, and chemical data indicate deviation from a terrane of older igneous rocks.

In general, the geochemical and radiometric data for the Precambrian W and X (?) target units provide no indication of anomalous uranium contents or of abnormal radioactivity. Mean radiometrically equivalent, and mean chemically-determined potassium and uranium contents are closely comparable to those of an average igneous rock (tables C-I through C-VII and figs. C-2, C-3, and C-8 through C-11, appendix C). In contrast, the mean radiometric and mean chemical thorium contents are significantly

higher than those of an average igneous rock (comparative data are those of Hem, 1970, p. 7). The mean or median Th/U ratio for all rock samples likewise compares favorably to that of an average igneous rock (table C-I, appendix C). However, a comparison of either the mean, median, or modal uranium content (Uf or Ut) with the corresponding thorium content for the Archean adamellite (table C-VI appendix C) suggests some uranium has been mobilized out of this rock. The amount in question is probably not large and may readily be explained by any one of three processes known to have affected the Archean adamellite, namely regional metamorphism, sodium metasomatism by Oligocene adamellite intrusions, or weathering. Approximately one-third of the geochemical anomalies correspond to Archean adamellite or adamellite gneiss, and 125 out of a total of 156 geochemical anomalies correspond to Archean and Precambrian X (?) target units. None of these anomalies, however, could be unequivocally attributed to uranium mineralization.

Few data are available on climate and weathering rates and types. In general, mineralogic and lithologic data of the target units are compatible with a cool temperate climate and dominantly mechanical weathering. Paraconglomerates were noted only locally in the Archean metasedimentary rocks. They may be glacial deposits or submarine mass flow deposits. This problem remains unresolved because of generally poor exposures and the effects of regional metamorphism.

The atmosphere during Archean time is considered to have been non-oxidizing with respect to uranium and pyrite (Houston and Karlstrom, 1980).

Thus, during Precambrian W time an atmosphere prevailed which was conducive to transport and preservation of uranium and pyrite in surficial environments, but within the study area conditions were unfavorable for the development of oligomictic conglomerates. Thus, Archean target units lack potential to host quartz-pebble conglomerate uranium deposits. In contrast, the Elba and Yost Quartzites of Precambrian X (?) age contain potentially favorable lithologies, but mineralogic data indicate oxidizing conditions prevailed during erosion, transport, and sedimentation. This is evidenced by the presence of hematitic schists and quartzites.

Definitive data concerning the age of the Elba and Yost Quartzites are lacking. The preferred interpretation is that they are Precambrian X (?). Nonetheless, the mineralogic data suggest they probably post-date a non-oxidizing atmosphere and are, therefore, too young to host important Proterozoic quartz-pebble conglomerate uranium deposits.

The Elba and Yost Quartzites are interpreted to have been deposited in shallow, low to high energy, marine environments. This interpretation is based on the areal extent of units, their uniformity, bedding styles, and lack of diagnostic fluvial features. Transgressive conditions are suggested by stratigraphic, lithologic, and textural data, with the Elba Conglomerates and Yost Quartzites perhaps representing sedimentation during rejuvenation of the source area and temporary regressions of the strandline.

The mineralogy of the Elba and Yost Quartzites also argues against the possibility of placer type uranium mineralization. The known

uraniferous minerals include monazite, zircon, and possibly uranothorite. Allanite is likely present because it is a common accessory in the Archean adamellite, but as yet it has not been identified or reported. Samarskite is present in metamorphic segregations in an Archean schist (Bill Gallant, oral communication, 11/13/79), but it may be related to Mesozoic and Cenozoic regional metamorphism. Pyrite of detrital origin is conspicuously lacking in the Elba and Yost Quartzites. Epigenetic pyrite was observed in both units at a number of localities, but it exhibits a wide range of crystal sizes, is obviously related to fracturing of quartzites, and probably relates to hydrothermal mineralization of Tertiary age.

Lithology, sedimentary structures, geometry, stratigraphy, metamorphism, and the profound regional unconformity separating Precambrian W and X (?) units have already been discussed in some detail in prior sections of this report. Target units, for the most part, exhibit amphibolite grade metamorphism. Houston and Karlstrom (1980) emphasized that to date no economic deposits have been found in amphibolite grade host rocks. These variables, like most of those listed in table VII are merely suggestive of, and not diagnostic of uranium mineralization.

In summary, the various statistical, radiometric, geologic, and geochemical data discussed in some detail in the foregoing section of this report strongly support the interpretation that the lithostratigraphic units pre-selected for evaluation of their uranium potential are unlikely hosts to important Precambrian quartz-pebble conglomerate uranium deposits.

CONCLUSIONS

Consideration of the various geologic, radiometric, geochemical, and statistical data presented in the foregoing sections of this report leads to the conclusion that the lithostratigraphic units pre-selected for evaluation lack potential to host important Proterozoic quartz-pebble conglomerate uranium deposits. It is likewise doubted that they possess any potential to host Proterozoic unconformity-type uranium deposits. However, the data suggest the possibility of vein, or very weakly disseminated, uranium mineralization in certain areas where geochemical and airborne radiation anomalies, with or without associated sulfide mineralization, correspond to exposures of Precambrian W or X (?) target units. Sodium metasomatism and biotite-muscovite adamellites characterize some of the anomalies in Archean adamellite. Prospective areas for this type of uranium mineralization include the mantled gneiss dome in the central Grouse Creek Mountains, the area between the Left Hand Fork of Johnson Creek and Charleston Creek, the Century Hollow mining area, the Cedar Hills area, the Upper Narrows area, and the Ashbrook mining district. All are considered relatively remote possibilities, but additional field checking of these areas is recommended as a precautionary measure.

Within the time and budget constraints imposed by the study objectives, it was not possible to investigate or sample the Paleozoic and Tertiary rocks. An objective appraisal of their uranium potential, therefore, is lacking and outside the scope of this report. Nonetheless, a few

comments are appropriate at this point. The Paleozoic rocks are dominantly marine carbonates deposited in the Cordilleran miogeosyncline. They are viewed as poor sources and unlikely hosts of important uranium mineralization. However, inasmuch as they have been important sources of precious metal sulfide ores, Paleozoic carbonates may contain small to intermediate size, intermediate to high grade, hydrothermal vein deposits of uranium. The paucity of PRR's in the study area suggests many, if not most, of the mines were not checked during the frenzied exploration effort of the 1950's. Finally, Tertiary intrusive and volcanic rocks and tuffaceous, fluvial-lacustrine, basin-fill sediments appear to possess some potential to host vein, contact metasomatic, volcanogenic, carbonaceous shale and lignite, and possibly sandstone type, uranium deposits. It was not possible to properly assess this potential nor to define prospective areas in greater detail than is indicated by the known uranium occurrences.

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APPENDICES

APPENDIX A - WATER

TABLES

FIGURES

APPENDIX B

STREAM SEDIMENTS

TABLES

FIGURES

APPENDIX C
ROCKS

TABLES

Page

FIGURES

Page

RAFT RIVER PROJECT STREAM WATER

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE (ppm)	MAXIMUM VALUE (ppm)	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	ROBUST MEAN	ROBUST S. D.
U	192	22	<0.20	<0.20	28.20	3.01	1.33	<0.20	4.298	1.427	0.48	1.09	0.23	1.39
AG	73	140	<2	<2	32	4	<2	<2	4.5	1.1	1.15	0.60		
AL	100	113	<10	<10	212	29	<10	<10	31.3	1.1	3.10	0.66		
B	168	45	<4	<4	135	32	23	<4	22.4	0.7	3.22	0.77	2.94	1.15
BA	212	1	<2	<2	124	26	18	15	21.0	0.8	3.01	0.73	3.02	0.73
BE	26	187	<1	<1	95	4	<1	<1	18.4	3.9	0.24	0.94		
CA	213			2.1	81.9	28.7	23.6	23.6	20.04	0.70	3.04	0.89	3.08	0.89
CD	64	149	<2	<2	89	4	<2	<2	10.8	2.3	1.16	0.60		
CR	25	188	<4	<4	102	9	<4	<4	19.4	2.1	1.77	0.67		
CU	13	200	<2	<2	92	9	<2	<2	24.8	2.6	1.17	1.05		
FE	139	74	<10	<10	1051	43	14	<10	97.1	2.3	3.32	0.75	2.66	0.96
K	213			0.3	9.4	2.2	1.9	2.4	1.45	0.67	0.58	0.63	0.59	0.60
LI	178	35	<2	<2	101	6	4	<2	8.5	1.3	1.62	0.71	1.38	0.93
MG	213			0.3	27.3	5.7	4.7	2.0	4.08	0.72	1.44	0.85	1.48	0.85
MN	19	194	<2	<2	3236	202	<2	<2	737.6	3.6	2.20	2.21		
MO	48	165	<4	<4	60	9	<4	<4	10.2	1.1	2.02	0.54		
NA	213			1.2	75.0	15.8	13.6	2.8	12.13	0.77	2.44	0.86	2.45	0.84
NI	44	169	<4	<4	91	8	<4	<4	13.7	1.5	1.86	0.63		
P	25	188	<40	<40	181	65	<40	<40	32.2	0.5	4.09	0.40		
SC	18	195	<1	<1	87	5	<1	<1	20.2	3.4	0.31	1.07		
SI	213			0.1	21.9	7.4	6.3	4.9	4.32	0.58	1.81	0.70	1.84	0.64
SR	213			11	479	124	105	104	86.0	0.7	4.57	0.76	4.59	0.82
TI	12	201	<2	<2	92	10	<2	<2	25.8	2.5	1.25	1.10		
V	48	165	<4	<4	83	10	<4	<4	12.2	1.2	2.08	0.64		
Y	49	164	<1	<1	90	2	<1	<1	12.7	4.3	0.16	0.70		
ZN	65	148	<4	<4	89	12	<4	<4	12.0	0.9	2.33	0.63		
ZR	51	162	<2	<2	93	5	<2	<2	12.7	2.5	1.16	0.66		
AS	55	1	<0.1	<0.1	2.8	1.0	<0.5	<0.5	0.58	0.59	-0.16	0.51		
		157	<0.5											
SE	96	1	<0.1	<0.1	1.4	0.4	<0.2	<0.2	0.17	0.42	-0.97	0.39		
		116	<0.2											
SO4	87	125	<5	<5	29	11	<5	<5	6.5	0.6	2.26	0.51		
CL	134	78	<10	<10	118	36	16	<10	23.3	0.6	3.40	0.62	2.83	1.04
PH	38			6.4	8.4	7.5	7.5	7.8	0.45	0.06				
T-AK	31			21	235	95	93	90	57.4	0.6	4.38	0.65	4.38	0.75

Table A-I Summary statistics for stream water samples in ppm.

RAFT RIVER PROJECT - SPRINGS

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	ROBUST MEAN	ROBUST S. D.
U	107	9	<0.20	<0.20	43.14	2.87	0.87	0.50	5.787	2.016	0.21	1.15	-0.02	1.37
AG	41	75	<2	<2	16	3	<2	<2	2.5	0.7	1.10	0.49		
AL	66	50	<10	<10	5441	143	<10	<10	672.2	4.7	3.47	1.21		
B	90	26	<4	<4	116	31	18	<4	24.0	0.8	3.19	0.76	2.87	1.10
BA	115	1	<2	<2	142	24	19	21	21.7	0.9	2.91	0.78	2.90	0.81
BE	15	101	<1	<1	7	1	<1	<1	1.8	1.0	0.31	0.66		
CA	116			1.7	137.9	30.4	19.3	5.4	26.82	0.88	2.97	1.02	2.99	1.01
CD	43	73	<2	<2	52	4	<2	<2	7.6	1.9	1.07	0.57		
CR	12	104	<4	<4	183	20	<4	<4	51.2	2.5	2.02	1.05		
CU	16	100	<2	<2	126	12	<2	<2	31.2	2.6	1.31	1.16		
FE	87	29	<10	<10	3165	93	29	<10	340.3	3.7	3.67	1.00	3.17	1.31
K	116			0.2	13.5	2.0	1.5	1.0	1.81	0.91	0.42	0.72	0.41	0.72
LI	96	20	<2	<2	26	6	4	<2	4.8	0.7	1.66	0.67	1.43	0.78
MG	116			0.4	39.7	5.9	3.8	2.9	6.03	1.02	1.36	0.93	1.36	1.03
MN	23	93	<2	<2	1019	118	<2	<2	306.9	2.6	1.96	2.02		
MO	35	81	<4	<4	22	8	<4	<4	4.8	0.6	2.03	0.50		
NA	116			0.8	70.8	16.5	11.8	3.6	15.01	0.91	2.38	0.99	2.40	1.04
NI	25	91	<4	<4	80	9	<4	<4	15.3	1.5	1.92	0.71		
P	10	106	<40	<40	964	262	<40	<40	347.1	1.3	4.85	1.20		
SC	14	102	<1	<1	22	2	<1	<1	5.6	2.1	0.35	0.86		
SI	115	1	<0.1	<0.1	21.2	7.3	6.1	3.4	4.66	0.63	1.77	0.73	1.79	0.77
SR	116			12	762	136	97	25	122.3	0.9	4.55	0.89	4.56	0.90
TI	14	102	<2	<2	4958	374	<2	<2	1320.2	3.5	2.52	2.06		
V	30	86	<4	<4	147	13	<4	<4	26.0	1.9	2.13	0.80		
Y	32	84	<1	<1	11	1	<1	<1	1.9	1.3	0.16	0.53		
ZN	40	76	<4	<4	449	25	<4	<4	69.9	2.7	2.49	0.96		
ZR	30	86	<2	<2	37	4	<2	<2	6.3	1.6	1.08	0.59		
AS	29	87	<0.5	<0.5	24.0	1.7	<0.5	<0.5	4.32	2.54	-0.10	0.78		
SE	52	64	<0.2	<0.2	2.0	0.4	<0.2	<0.2	0.34	0.76	-0.93	0.43		
SO4	51	65	<5	<5	254	24	<5	<5	37.3	1.7	2.59	0.84		
CL	70	46	<10	<10	195	50	17	<10	42.6	0.9	3.63	0.74	2.83	1.34
PH	9			6.7	8.0	7.1	7.0	7.0	0.38	0.05				
T-AK	8			21	128	52	36	64	34.1	0.6	3.81	0.56		

Table A-II. Summary statistics for spring water samples.

RAFT RIVER WATERS

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	S. D.	ROBUST MEAN	S. D.
U	303	31	<0.20	<0.20	43.14	2.97	1.18	0.50	4.843	1.628	0.40	1.12	0.16	1.38
AG	116	217	<2	<2	32	3	<2	<2	3.8	1.0	1.13	0.56		
AL	166	167	<10	<10	5441	74	<10	<10	426.3	5.7	3.24	0.94		
B	263	70	<4	<4	135	32	22	<4	23.5	0.7	3.22	0.77	2.93	1.13
BA	331	2	<2	<2	142	26	19	15	21.4	0.8	2.99	0.75	2.99	0.80
BE	42	291	<1	<1	95	3	<1	<1	14.5	4.0	0.26	0.83		
CA	333			1.7	137.9	29.5	23.3	5.1	22.56	0.76	3.03	0.94	3.06	0.92
CO	107	226	<2	<2	89	4	<2	<2	9.6	2.2	1.12	0.59		
CR	37	296	<4	<4	183	13	<4	<4	32.9	2.5	1.85	0.80		
CU	29	304	<2	<2	126	10	<2	<2	28.0	2.6	1.25	1.09		
FE	229	104	<10	<10	3165	61	15	<10	223.6	3.6	3.45	0.87	2.85	1.07
K	333			0.2	13.5	2.1	1.8	1.0	1.59	0.75	0.53	0.67	0.53	0.64
LI	278	55	<2	<2	101	6	4	<2	7.4	1.1	1.64	0.69	1.40	0.88
MG	333			0.3	39.7	5.8	4.7	1.9	4.89	0.84	1.43	0.88	1.45	0.89
MN	46	287	<2	<2	3236	143	<2	<2	516.9	3.6	2.03	2.00		
MO	84	249	<4	<4	60	9	<4	<4	8.3	0.9	2.02	0.52		
NA	333			0.8	75.0	16.2	13.2	2.4	13.22	0.82	2.43	0.90	2.45	0.87
NI	70	263	<4	<4	91	9	<4	<4	14.1	1.5	1.88	0.65		
P	35	298	<40	<40	964	121	<40	<40	201.9	1.7	4.31	0.78		
SC	32	301	<1	<1	87	4	<1	<1	15.5	3.4	0.33	0.97		
SI	332	1	<0.1	<0.1	26.7	7.5	6.3	3.1	4.61	0.61	1.81	0.72	1.84	0.68
SR	333			11	762	130	104	46	100.2	0.8	4.57	0.81	4.59	0.82
TI	26	307	<2	<2	4958	206	<2	<2	970.0	4.7	1.93	1.78		
V	80	253	<4	<4	147	11	<4	<4	18.4	1.6	2.08	0.70		
Y	81	252	<1	<1	90	2	<1	<1	9.9	4.2	0.16	0.63		
ZN	107	226	<4	<4	1336	42	<4	<4	174.1	4.1	2.51	1.03		
ZR	81	252	<2	<2	93	4	<2	<2	10.7	2.3	1.13	0.63		
PH	47			6.4	8.4	7.4	7.3	7.8	0.47	0.06				
BC	39			9.35	139.11	48.31	42.56	27.44	33.115	0.685	3.64	0.74	3.54	0.81
AS	88	1	<0.1	<0.1	24.0	1.2	<0.5	<0.5	2.52	2.07	-0.14	0.60		
		244	<0.5											
SE	150	1	<0.1	<0.1	2.6	0.4	<0.2	<0.2	0.24	0.58	-0.96	0.41		
		182	<0.2											
SO4	141	191	<5	<5	254	14	<5	<5	23.5	1.6	2.38	0.67		
CL	209	123	<10	<10	195	40	17	<10	31.5	0.8	3.48	0.67	2.85	1.03

Table A-III. Summary statistics for all water samples

	L-U	L-CA	L-SR	L-MG	L-K	L-B	L-NA	L-LI	L-BA	L-SI	L-AL	L-FE
L-U	1.00 (304)											
L-CA	0.48*** 0.50*** (303)	1.00 (334)										
L-SR	0.53*** 0.54*** (303)	0.94*** 0.93*** (334)	1.00 (334)									
L-MG	0.53*** 0.56*** (303)	0.92*** 0.89*** (334)	0.94*** 0.92*** (334)	1.00 (334)								
L-K	0.46*** 0.51*** (303)	0.65*** 0.60*** (334)	0.66*** 0.64*** (334)	0.73*** 0.69*** (334)	1.00 (334)							
L-B	0.40*** 0.41*** (246)	0.61*** 0.60*** (264)	0.70*** 0.71*** (264)	0.71*** 0.73*** (264)	0.58*** 0.58*** (264)	1.00 (264)						
L-NA	0.55*** 0.56*** (303)	0.77*** 0.73*** (334)	0.85*** 0.84*** (334)	0.87*** 0.86*** (334)	0.69*** 0.67*** (334)	0.83*** 0.86*** (264)	1.00 (334)					
L-LI	0.48*** 0.47*** (264)	0.61*** 0.61*** (279)	0.73*** 0.75*** (279)	0.74*** 0.75*** (279)	0.58*** 0.56*** (279)	0.72*** 0.75*** (255)	0.77*** 0.81*** (279)	1.00 (279)				
L-BA	0.30*** 0.30*** (301)	0.52*** 0.51*** (332)	0.63*** 0.64*** (332)	0.60*** 0.61*** (332)	0.57*** 0.58*** (332)	0.52*** 0.53*** (264)	0.57*** 0.60*** (332)	0.57*** 0.58*** (278)	1.00 (332)			
L-SI	0.36*** 0.41*** (301)	0.50*** 0.45*** (332)	0.52*** 0.51*** (332)	0.53*** 0.51*** (332)	0.65*** 0.66*** (332)	0.38*** 0.42*** (263)	0.57*** 0.54*** (332)	0.47*** 0.53*** (278)	0.44*** 0.50*** (330)	1.00 (332)		
L-AL	-0.15* -0.09 (147)	-0.16** -0.11 (166)	-0.12 -0.08 (166)	-0.09 -0.06 (166)	0.03 0.05 (166)	-0.08 -0.04 (123)	-0.10 -0.07 (166)	0.01 -0.05 (132)	0.04 0.03 (166)	0.10 0.06 (166)	1.00 (166)	
L-FE	-0.31*** -0.27*** (208)	-0.13** -0.10 (230)	-0.09 -0.04 (230)	-0.05 -0.01 (230)	-0.08 -0.04 (230)	-0.18** -0.17** (188)	-0.10 -0.05 (230)	0.02 0.08 (191)	0.04 0.02 (228)	-0.11 -0.21*** (228)	0.67*** 0.55*** (52)	1.00 (230)

Notes:

(1) Pearson correlation/Spearman correlation/sample size. If either element has concentration level below the detection limit, it is omitted from the pairwize computation.

(2) Significance levels:

* - .10

** - .05

*** - .01

TABLE A-IV. Correlation matrix for variables determined in water samples.

RAFT RIVER WATER

SECTION 1 OF 3

CR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L	TY	REP	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CO (PPB)	CR (PPB)	CU (PPB)	FE (PPB)
154478	40	41.682	-113.709	-3-	01	-	12.22	<2	17.7	50	25	<1	33.7	<2	<4	<2	16
154481	40	41.692	-113.697	-3-		-	4.32	10	10	135	19	<1	20.3	<2	<4	<2	10
154483	40	41.705	-113.703	-3-		-	1.25	4	10	22	9	1	13.4	<2	<4	<2	24
154485	40	41.706	-113.702	-3-		-	6.40	3	25	24	10	<1	14.9	3	<4	<2	19
154492	40	42.265	-113.620	-3-	01	-	5.19	<2	28	4	18	1	24.0	<2	<4	2	<10
154516	40	41.806	-113.625	-3-	01	-	0.64	<2	63	65	34	<1	34.7	<2	<4	2	20
154520	40	41.808	-113.617	-3-		-	6.26	<2	31	116	75	<1	50.5	<2	<4	4	21
154522	40	41.743	-113.672	-3-		-	7.41	<2	<10	29	20	<1	37.9	<2	<4	2	16
154527	40	41.932	-113.596	-3-		-	3.30	2	<10	75	50	<1	72.5	<2	<4	2	14
154530	40	41.931	-113.561	-3-		-	2.98	<2	<10	62	47	<1	63.2	<2	<4	<2	15
154538	40	41.717	-113.738	-3-	01	-	0.53	<2	52	16	14	<1	5.9	<2	<4	2	46
154541	40	41.739	-113.759	-3-		-	5.09	2	<10	42	16	<1	21.2	<2	<4	<2	18
154544	40	41.741	-113.750	-3-		-	6.16	<2	<10	45	15	<1	21.1	<2	<4	<2	19
154546	40	41.731	-113.786	-3-		-	2.65	<2	<10	57	54	<1	42.8	<2	<4	<2	14
154559	40	41.809	-113.681	-3-	01	-	1.89	2	16	43	26	<1	29.9	<2	<4	<2	14
154563	40	41.786	-113.640	-3-	01	-	0.70	4	54	17	17	1	7.7	<2	<4	<2	47
154564	40	41.778	-113.646	-3-	01	-	0.57	<2	13	28	33	<1	19.4	<2	<4	3	19
154576	40	41.689	-113.726	-3-	01	-	2.10	<2	14	14	16	<1	10.8	<2	<4	<2	13
154579	40	41.702	-113.720	-3-		-	0.29	<2	<10	11	7	<1	7.3	<2	<4	<2	15
154585	40	41.983	-113.864	-3-		-	0.44	<2	21	47	57	1	35.4	<2	<4	<2	1051
154588	40	41.966	-113.846	-3-	01	-	2.06	2	<10	44	30	<1	137.9	2	<4	<2	152
154590	40	41.961	-113.859	-3-		-	2.99	<2	<10	22	11	<1	64.3	<2	<4	<2	15
154595	40	41.911	-113.788	-3-	01	-	0.32	<2	113	26	31	<1	15.3	<2	<4	2	81
154597	40	41.901	-113.769	-3-		-	0.91	<2	24	30	14	<1	16.9	<2	<4	<2	36
154599	40	41.918	-113.762	-3-	01	-	0.59	<2	73	44	94	<1	24.4	6	<4	<2	88
154600	40	41.924	-113.794	-3-	01	-	0.99	<2	13	27	28	<1	17.4	<2	<4	<2	12
154602	40	41.936	-113.789	-3-		-	<0.20	<2	27	13	15	<1	15.6	<2	<4	<2	11
154604	40	41.952	-113.776	-3-		-	1.65	<2	10	18	13	<1	35.9	<2	<4	<2	12
154610	40	42.286	-113.586	-3-	01	-	0.36	<2	31	<4	19	1	6.5	3	<4	<2	<10
154616	40	41.781	-113.584	-3-	01	-	0.62	<2	20	39	17	<1	15.3	<2	<4	<2	13
154617	40	41.755	-113.604	-3-	01	-	2.38	<2	34	39	35	<1	36.2	<2	<4	<2	13
154621	40	41.757	-113.664	-3-	01	-	1.07	16	18	56	46	<1	56.9	<2	<4	<2	24
154623	40	41.751	-113.677	-3-		-	0.93	3	11	43	29	1	63.3	4	<4	<2	22
154625	40	41.751	-113.687	-3-		-	9.35	3	21	56	44	<1	38.8	<2	<4	<2	12
154627	40	41.751	-113.693	-3-		-	1.66	4	<10	26	26	<1	58.6	4	4	<2	16
154681	40	42.113	-113.776	-3-	01	-	1.14	2	<10	15	21	<1	26.2	<2	<4	<2	43
154682	40	42.114	-113.777	-3-		-	1.45	3	<10	30	32	<1	30.6	2	6	<2	47
154683	40	42.130	-113.776	-3-		-	0.66	3	<10	10	24	<1	40.5	<2	<4	<2	41
154684	40	42.143	-113.782	-3-	01	-	1.35	2	<10	34	30	<1	42.4	2	5	<2	51
154685	40	42.152	-113.784	-3-	01	-	1.30	2	<10	9	9	<1	41.5	<2	<4	<2	41
154686	40	42.149	-113.765	-3-	01	-	1.65	2	<10	31	39	<1	50.8	2	<4	<2	43
154687	40	42.164	-113.786	-3-		-	0.68	<2	<10	5	10	<1	24.9	<2	<4	<2	39
154688	40	42.153	-113.656	-3-	01	-	22.67	<2	<10	<4	<2	<1	15.5	<2	<4	<2	40
154689	40	42.161	-113.643	-3-		-	0.32	<2	<10	4	4	<1	6.1	<2	<4	<2	10
154690	40	42.154	-113.663	-3-		-	<0.20	<2	<10	<4	5	<1	4.9	<2	<4	<2	14
154691	40	41.930	-113.240	-3-		-	1.41	<2	115	<4	7	<1	7.7	<2	<4	<2	34
154693	40	41.922	-113.331	-3-		-	4.21	<2	51	4	9	<1	10.6	<2	<4	<2	<10
154695	40	41.924	-113.324	-3-		-	1.20	<2	<10	15	18	<1	17.3	3	<4	<2	<10
154698	40	41.894	-113.222	-3-		-	2.32	8	30	23	29	<1	21.4	8	13	<2	<10
154700	40	41.939	-113.326	-3-		-	2.55	<2	18	15	16	<1	15.5	<2	<4	<2	<10
154702	40	41.947	-113.454	-3-		-	0.48	<2	43	27	24	<1	33.6	<2	<4	<2	<10
154704	40	41.943	-113.425	-3-		-											
154706	40	41.935	-113.428	-3-		-	0.92	<2	11	20	27	<1	23.8	<2	<4	<2	<10
154708	40	41.943	-113.421	-3-		-	3.49	<2	<10	35	43	<1	60.5	2	<4	<2	<10
154710	40	41.943	-113.420	-3-		-	<0.20	2	<10	34	31	<1	32.8	<2	<4	<2	<10

TABLE A-V. Analyses of water samples

1-a

RAFT RIVER WATER — SECTION 2 OF 3

OR SAMPLE NUMBER	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)	Y (PPB)	ZN (PPB)
154478	3.0	11	9.0	<2	9	36.0	4	<40	<1	10.9	156	<2	13	<1	11
154481	2.9	4	3.3	2	7	10.6	33	<40	<1	7.7	81	<2	<4	<1	39
154483	2.1	3	3.2	<2	<4	12.7	6	<40	<1	9.3	61	<2	14	1	8
154485	2.2	4	3.4	<2	<4	14.0	<4	<40	<1	9.5	68	<2	6	<1	4
154492	1.2	3	4.8	<2	<4	6.6	<4	<40	1	6.1	85	<2	<4	<1	15
154516	3.9	13	8.5	<2	<4	48.5	<4	<40	<1	13.8	191	<2	<4	<1	48
154520	8.3	24	14.8	<2	<4	73.8	<4	<40	<1	0.7	332	<2	<4	<1	8
154522	2.4	3	6.7	<2	<4	20.8	<4	<40	<1	7.6	140	<2	5	<1	<4
154527	5.0	17	12.7	<2	<4	46.3	<4	<40	<1	15.1	324	<2	13	<1	11
154530	3.7	14	11.7	<2	<4	41.2	<4	<40	<1	15.3	282	<2	<4	<1	6
154538	1.5	2	1.6	<2	<4	6.2	10	<40	<1	8.0	34	<2	21	<1	5
154541	3.9	5	5.0	<2	8	21.4	10	<40	<1	12.4	108	<2	<4	1	6
154544	2.9	5	5.3	<2	<4	26.1	<4	<40	<1	11.3	103	<2	<4	<1	8
154546	6.4	12	10.0	<2	<4	26.6	<4	<40	<1	20.0	206	<2	<4	<1	9
154559	2.0	7	6.8	<2	<4	27.6	<4	48	<1	9.3	132	<2	16	<1	5
154563	0.6	2	1.8	<2	<4	6.7	<4	<40	<1	5.9	48	2	6	1	<4
154564	1.5	5	4.7	<2	<4	21.7	<4	<40	<1	4.0	101	<2	9	<1	4
154576	2.2	4	2.8	<2	<4	10.9	<4	<40	<1	8.3	49	<2	<4	<1	<4
154579	1.7	2	1.9	<2	<4	7.4	<4	<40	<1	8.2	35	<2	<4	<1	<4
154585	3.9	4	6.7	3236	4	16.9	<4	<40	<1	11.7	127	<2	<4	<1	6
154588	8.4	10	39.7	985	<4	9.7	5	<40	<1	9.1	355	<2	<4	1	9
154590	1.6	3	9.4	5	<4	9.2	<4	<40	<1	7.4	147	<2	<4	<1	<4
154595	2.8	9	3.9	<2	<4	18.0	<4	<40	<1	21.1	98	4	11	<1	5
154597	2.7	7	4.2	<2	7	17.8	<4	<40	<1	15.4	98	<2	9	<1	<4
154599	7.8	18	6.3	31	5	30.9	8	<40	<1	13.4	163	<2	23	<1	<4
154600	1.6	9	4.5	<2	<4	22.1	4	<40	<1	16.4	110	<2	4	<1	<4
154602	1.6	4	2.6	<2	<4	7.5	<4	<40	<1	10.0	64	<2	<4	<1	<4
154604	1.5	3	3.9	<2	<4	9.8	<4	<40	<1	12.3	104	<2	<4	<1	<4
154610	1.1	2	1.7	<2	6	5.4	<4	<40	1	4.1	41	<2	<4	<1	<4
154616	1.2	6	3.7	<2	<4	18.2	<4	<40	<1	6.9	82	<2	9	<1	4
154617	2.4	9	8.3	<2	22	30.8	<4	<40	<1	8.7	156	<2	5	<1	<4
154621	3.7	5	6.4	2	<4	19.2	7	43	<1	8.9	159	<2	<4	<1	24
154623	3.5	5	7.1	16	6	16.3	4	<40	<1	5.8	201	<2	17	1	6
154625	2.4	5	6.9	2	5	20.0	7	45	<1	8.8	166	<2	<4	<1	20
154627	1.8	3	7.1	<2	<4	15.7	<4	<40	<1	6.4	193	<2	30	1	5
154681	2.5	6	5.7	<2	<4	15.1	5	<40	<1	14.9	137	<2	<4	<1	<4
154682	3.3	7	7.1	<2	9	22.1	8	63	<1	14.9	162	<2	8	1	<4
154683	2.2	3	6.9	<2	<4	8.1	<4	<40	<1	8.8	151	<2	<4	1	<4
154684	1.5	10	7.8	<2	<4	18.3	<4	94	<1	14.6	196	<2	4	1	<4
154685	3.1	5	7.2	<2	4	9.2	<4	<40	<1	10.5	153	<2	<4	<1	<4
154686	5.7	4	8.8	<2	5	13.2	<4	64	<1	14.4	208	<2	5	<1	<4
154687	2.4	5	4.6	<2	10	7.6	<4	<40	<1	10.1	86	<2	<4	<1	<4
154688	0.9	8	1.9	<2	4	11.3	<4	<40	<1	9.7	97	<2	<4	<1	<4
154689	0.7	<2	1.6	<2	<4	7.3	4	<40	<1	9.4	44	<2	<4	<1	<4
154690	0.7	<2	1.2	<2	<4	4.6	<4	<40	<1	6.6	33	<2	<4	<1	<4
154691	0.8	2	1.9	<2	<4	5.1	<4	<40	<1	1.5	46	2	<4	<1	<4
154693	1.0	2	2.6	<2	<4	6.4	<4	<40	<1	1.4	61	<2	<4	<1	<4
154695	1.7	2	4.2	<2	8	11.8	<4	<40	1	2.4	85	<2	<4	<1	<4
154698	1.9	2	5.6	<2	<4	13.7	5	<40	<1	3.6	95	2	14	2	<4
154700	1.5	2	3.8	<2	<4	10.8	<4	<40	<1	2.8	82	<2	<4	<1	14
154702	2.0	5	7.2	<2	<4	16.5	<4	60	<1	4.6	152	<2	<4	<1	8
154704															
154706	1.9	5	5.5	<2	<4	13.8	<4	<40	<1	4.0	108	<2	<4	<1	9
154708	1.7	9	10.8	<2	<4	33.4	<4	<40	<1	4.8	198	<2	4	<1	18
154710	1.9	7	6.7	<2	<4	22.3	<4	42	<1	5.1	140	<2	<4	1	15

TABLE A-V. Analyses of water samples

1-b

RAFT RIVER WATER

OR SAMPLE NUMBER	ZR (PPB)	PH	BC (PPM)	AS (PPB)	SE (PPB)	SO4 (PPM)	CL (PPM)	T-AK (PPM)	BTDS	ATDS
154478	<2			0.7	0.6	14	42		149.60	
154481	6			<0.5	<0.2	<5	21		69.30	
154483	4			<0.5	0.5	<5	14		58.20	
154485	<2			<0.5	0.3	<5	13		60.50	
154492	<2			<0.5	0.3	<5	<10		51.20	
154516	<2			0.9	0.7	9	76		195.40	
154520	<2			0.6	0.4	17	118		284.10	
154522	2			<0.5	0.5	17	40		133.40	
154527	<2			0.8	0.4	10	82		245.60	
154530	<2			0.8	0.5	7	75		218.10	
154538	<2			<0.5	0.3	<5	<10		31.70	
154541	3			<0.5	0.4	<5	25		92.40	
154544	<2			<0.5	0.4	<5	34		104.20	
154546	<2			0.5	0.4	<5	27		136.30	
154559	<2			<0.5	0.5	<5	45		124.10	
154563	3			<0.5	0.4	<5	<10		31.20	
154564	<2			<0.5	0.4	<5	38		92.80	
154576	<2			<0.5	0.4	<5	11		49.50	
154579	<2			<0.5	0.3	<5	<10		35.00	
154585	<2			0.5	0.4	<5	14		92.10	
154588	5			24.0	0.4	254	<10		464.80	
154590	2			2.2	0.8	10	11		113.90	
154595	<2			0.8	0.4	<5	18		82.60	
154597	4			0.8	0.4	<5	17		77.50	
154599	3			0.5	0.4	<5	41		127.30	
154600	2			<0.5	0.4	<5	26		91.50	
154602	<2			0.5	0.6	<5	<10		45.80	
154604	<2			<0.5	0.4	<5	<10		71.90	
154610	<2			<0.5	0.4	<5	<10		27.30	
154616	<2			1.2	0.5	<5	26		74.80	
154617	<2			1.0	0.4	<5	55		144.90	
154621	<2			<0.5	0.3	22	48		166.10	
154623	2			0.5	0.4	<5	27		126.50	
154625	<2			<0.5	<0.2	22	44		143.90	
154627	4			<0.5	0.6	<5	23		116.10	
154681	<2			<0.5	<0.2	<5	31		98.90	
154682	2			<0.5	<0.2	8	45		132.00	
154683	<2			<0.5	<0.2	<5	11		81.00	
154684	<2			0.8	0.3	8	30		123.60	
154685	<2			2.7	2.6	<5	15		90.40	
154686	<2			<0.5	<0.2	<5	18		114.40	
154687	<2			<0.5	<0.2	<5	<10		58.10	
154688	<2			<0.5	<0.2	<5	<10		47.80	
154689	<2			<0.5	<0.2	6	<10		37.10	
154690	<2			<0.5	0.2	<5	<10		26.50	
154691	<2	7.2	22.85	0.5	0.2	<5	<10	43	25.50	68.50
154693	<2	7.3	31.10	<0.5	<0.2	5	<10	57	34.00	91.00
154695	<2	7.2	30.29	<0.5	<0.2	9	12	57	58.40	115.40
154698	5	7.3	42.56	<0.5	<0.2	8	15	78	70.20	148.20
154700	<2	7.3	42.56	<0.5	<0.2	7	<10	78	47.40	125.40
154702	<2	7.3	62.21	<0.5	<0.2	7	21	114	92.90	206.90
154704		7.5	133.38					235		
154706	<2	7.1	47.83	0.5	<0.2	7	15	93	72.00	165.00
154708	<2	6.9	74.00	<0.5	<0.2	8	73	157	193.30	350.30
154710	<2	7.5	72.65	0.9	<0.2	<5	37	128	109.30	237.30

BTDS = Ca + K + Mg + Na + Si + SO_4 + Cl

ATDS = BTDS + total alkalinity

BC = bicarbonate anion

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L	TY	REP	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CO (PPB)	CR (PPB)	CU (PPB)	FE (PPB)
154712	40-	41.946	-113.333	-3-		-	1.96	4	134	12	13	<1	13.1	3	<4	<2	<10
154713	40-	41.941	-113.363	-3-		-	8.80	<2	13	33	31	<1	21.5	<2	<4	<2	<10
154715	40-	41.938	-113.372	-3-		-	0.99	<2	19	19	21	<1	22.6	<2	<4	<2	<10
154717	40-	41.868	-113.341	-3-	01	-	0.49	<2	32	<4	5	<1	6.6	<2	<4	<2	<10
154729	40-	******	-*******	-3-		-											
154737	40-	41.884	-113.214	-3-		-	1.18	2	<10	56	22	<1	42.0	3	<4	<2	<10
154741	40-	41.931	-113.253	-3-		-	2.05	<2	<10	74	44	<1	51.5	<2	<4	<2	<10
154746	40-	41.921	-113.207	-3-	01	-	0.49	2	18	29	53	<1	24.7	2	<4	<2	<10
154756	40-	41.941	-113.338	-3-		-	3.32	<2	24	33	37	<1	25.5	<2	<4	<2	<10
154766	40-	41.871	-113.254	-3-		-	1.03	<2	17	38	53	<1	29.9	<2	<4	<2	<10
154768	40-	41.874	-113.251	-3-		-	2.72	<2	26	35	45	<1	31.1	<2	<4	<2	<10
154771	40-	41.898	-113.287	-3-		-	2.42										
154772	40-	41.898	-113.283	-3-		-	0.99	<2	<10	24	32	<1	22.9	<2	<4	<2	<10
154774	40-	41.885	-113.258	-3-		-	7.37	<2	<10	47	54	<1	33.1	<2	<4	<2	<10
154776	40-	41.884	-113.261	-3-		-	1.73	<2	10	30	47	<1	27.7	4	4	<2	<10
154778	40-	41.903	-113.251	-3-		-	2.84	<2	27	45	43	<1	29.2	<2	<4	<2	<10
154782	40-	41.843	-113.543	-3-	01	-	0.38	<2	20	27	32	<1	15.4	2	<4	<2	<10
154783	40-	41.843	-113.521	-3-	01	-	2.48	<2	<10	26	63	<1	46.1	2	<4	<2	<10
154784	40-	41.845	-113.515	-3-		-	3.26	<2	13	32	26	<1	24.0	<2	<4	<2	<10
154786	40-	41.817	-113.611	-3-		-	4.81	<2	<10	56	46	<1	67.0	<2	<4	<2	<10
154788	40-	41.837	-113.619	-3-		-	2.21	<2	<10	61	45	<1	50.7	4	<4	<2	<10
154790	40-	42.157	-113.648	-3-		-	<0.20	<2	<10	8	15	<1	7.6	<2	<4	<2	12
154791	40-	42.315	-113.702	-3-		-	<0.20	<2	100	95	89	95	45.1	89	102	92	98
154793	40-	42.384	-113.630	-3-	01	-	2.09	<2	46	8	10	<1	5.4	<2	<4	<2	36
154797	40-	42.336	-113.694	-3-		-	0.62	3	<10	25	24	<1	56.3	3	5	<2	10
154800	40-	42.319	-113.775	-3-		-	<0.20	2	<10	30	80	<1	36.4	3	<4	<2	41
154803	40-	42.279	-113.564	-3-		-	0.52	<2	<10	7	6	<1	23.2	<2	<4	<2	36
154807	40-	42.265	-113.554	-3-		-	<0.20	<2	25	<4	13	<1	6.6	<2	<4	<2	47
154809	40-	42.150	-113.581	-3-		-	2.65	<2	<10	33	32	<1	32.4	<2	<4	<2	41
154810	40-	42.197	-113.587	-3-	01	-	<0.20	3	291	19	18	<1	13.7	2	5	<2	196
154811	40-	42.202	-113.570	-3-	03	-	2.25	<2	<10	31	59	<1	32.4	<2	<4	<2	37
154813	40-	42.247	-113.579	-3-	03	-	1.65	<2	<10	13	26	<1	34.1	<2	<4	<2	37
154815	40-	42.271	-113.580	-3-	01	-	<0.20	<2	10	<4	16	<1	4.6	<2	<4	<2	41
154817	40-	41.918	-113.562	-3-		-	1.94	<2	<10	47	18	<1	59.2	<2	<4	<2	32
154819	40-	41.917	-113.563	-3-		-	1.54	<2	<10	31	18	<1	51.8	<2	<4	<2	34
154822	40-	41.911	-113.561	-3-		-	1.90	<2	<10	32	17	<1	41.9	<2	<4	<2	41
154824	40-	42.176	-113.678	-3-		-	<0.20	<2	<10	<4	3	<1	2.4	<2	<4	<2	35
154826	40-	42.173	-113.671	-3-		-	0.36	<2	<10	<4	<2	<1	3.1	<2	<4	<2	33
154831	40-	42.170	-113.691	-3-		-	0.33	3	<10	<4	10	<1	7.8	<2	<4	<2	31
154833	40-	42.087	-113.696	-3-		-	0.49	<2	<10	<4	8	<1	24.7	<2	<4	<2	33
154835	40-	42.163	-113.701	-3-		-	<0.20	<2	107	<4	8	<1	4.1	<2	<4	<2	95
154841	40-	42.310	-113.520	-3-		-	0.27	<2	27	11	13	<1	9.4	2	<4	<2	52
154847	40-	42.101	-113.187	-3-		-	<0.20	<2	<10	5	12	<1	6.8	<2	<4	<2	42
154848	40-	42.109	-113.186	-3-		-	0.28	<2	11	<4	11	<1	4.5	<2	<4	<2	36
154854	40-	42.127	-113.166	-3-	01	-	0.27	2	247	28	26	<1	17.3	2	<4	<2	161
154855	40-	41.949	-133.349	-3-		-	2.84	<2	<10	7	7	<1	12.0	<2	<4	<2	43
154858	40-	41.954	-113.356	-3-		-	1.72	<2	<10	10	10	<1	13.3	<2	<4	<2	35
154860	40-	42.196	-113.668	-3-		-	<0.20	<2	13	<4	2	<1	2.1	2	<4	<2	29
154863	40-	42.204	-113.642	-3-		-											
154865	40-	42.215	-113.627	-3-		-	<0.20	2	<10	<4	9	<1	5.1	3	<4	<2	38
154867	40-	42.223	-113.639	-3-		-	0.31	<2	<10	<4	10	<1	3.5	<2	<4	<2	43
154869	40-	42.108	-113.182	-3-	01	-	0.25	<2	18	5	25	<1	12.0	<2	<4	<2	43
154881	40-	41.724	-113.695	-3-		-	17.60	4	<10	26	9	<1	19.9	4	5	<2	23
154891	40-	42.211	-113.681	-3-		-	0.25	5	36	<4	7	1	4.4	4	<4	<2	<10
154893	40-	42.112	-113.762	-3-		-	0.67	4	18	27	41	1	29.8	<2	<4	<2	<10

TABLE A-V. Analyses of water samples

2-a

RAFT RIVER WATER — SECTION 2 OF 3

OR SAMPLE NUMBER	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)	Y (PPB)	ZN (PPB)
154712	1.0	3	3.3	<2	<4	8.9	<4	<40	<1	3.1	80	<2	5	1	12
154713	1.7	5	5.9	<2	<4	22.6	<4	70	<1	4.7	128	<2	7	<1	15
154715	1.8	4	5.0	<2	<4	14.8	<4	<40	<1	4.4	115	<2	<4	<1	<4
154717	0.7	2	1.6	<2	4	5.6	4	<40	<1	1.5	47	<2	<4	<1	10
154729															
154737	1.9	8	9.6	<2	13	30.8	6	<40	<1	5.4	226	<2	<4	1	<4
154741	2.2	9	14.4	<2	6	52.4	<4	<40	<1	6.5	212	<2	<4	<1	8
154746	3.0	3	6.8	<2	<4	23.7	<4	<40	<1	5.5	139	<2	10	1	<4
154756	1.3	10	6.8	<2	<4	29.8	<4	<40	<1	6.1	167	<2	<4	<1	<4
154766	1.1	9	7.4	<2	<4	21.8	<4	<40	<1	5.0	157	<2	<4	<1	7
154768	2.6	5	7.8	<2	<4	27.7	<4	<40	<1	5.4	147	<2	<4	<1	<4
154771															
154772	1.7	2	5.5	<2	<4	15.5	<4	<40	<1	3.1	98	<2	<4	<1	<4
154774	3.0	5	8.1	<2	<4	33.2	<4	<40	<1	6.1	162	<2	<4	<1	<4
154776	2.2	5	6.8	<2	<4	22.0	<4	<40	<1	5.0	128	<2	<4	1	<4
154778	3.1	4	7.2	<2	5	28.3	7	<40	<1	5.6	145	<2	<4	<1	26
154782	2.0	5	3.7	<2	<4	20.9	<4	<40	<1	3.0	104	<2	<4	<1	20
154783	2.3	6	5.8	<2	<4	28.2	<4	822	<1	4.5	173	<2	<4	1	<4
154784	2.2	5	6.0	<2	<4	26.3	<4	<40	<1	5.2	134	<2	<4	<1	15
154786	3.8	12	13.1	<2	9	35.9	<4	107	<1	11.8	302	<2	<4	<1	<4
154788	3.0	10	8.6	<2	<4	35.8	<4	91	<1	11.4	236	<2	<4	1	<4
154790	1.6	2	2.1	<2	<4	9.7	5	<40	<1	10.3	67	<2	<4	<1	<4
154791	9.4	101	17.1	89	60	31.2	91	90	87	9.4	94	92	83	90	89
154793	0.7	2	1.6	<2	<4	2.9	<4	<40	<1	5.5	29	<2	<4	<1	<4
154797	1.2	4	5.1	<2	10	9.6	<4	<40	<1	11.0	141	<2	<4	1	<4
154800	2.7	17	13.3	<2	10	22.5	<4	<40	<1	6.0	190	<2	<4	1	<4
154803	1.0	2	9.6	<2	<4	8.8	<4	<40	<1	1.9	68	<2	<4	<1	<4
154807	0.3	<2	1.7	<2	<4	5.6	<4	<40	<1	2.4	32	<2	<4	<1	<4
154809	2.9	7	7.1	<2	<4	16.5	<4	40	<1	11.2	165	<2	<4	<1	<4
154810	1.0	4	3.0	3	<4	9.0	<4	<40	<1	6.5	64	8	9	1	<4
154811	4.7	10	6.8	3	<4	20.0	<4	<40	<1	26.7	152	<2	4	<1	1336
154813	2.2	3	8.5	4	<4	13.0	<4	<40	<1	6.1	135	<2	4	<1	<4
154815	0.9	<2	1.1	<2	<4	3.8	<4	<40	<1	1.9	26	<2	4	<1	<4
154817	1.6	11	14.4	<2	<4	41.0	<4	<40	<1	4.9	263	<2	<4	<1	<4
154819	2.1	8	9.3	<2	<4	27.6	<4	<40	<1	5.5	211	<2	<4	<1	<4
154822	2.5	7	7.6	<2	<4	24.7	<4	<40	<1	5.4	178	<2	<4	<1	<4
154824	0.4	<2	0.4	<2	<4	2.1	<4	<40	<1	3.1	22	<2	<4	<1	<4
154826	0.4	<2	0.5	<2	<4	2.2	<4	<40	<1	2.5	16	<2	<4	<1	<4
154831	1.4	<2	1.4	<2	5	3.7	<4	<40	<1	4.9	43	<2	<4	<1	<4
154833	2.3	<2	3.4	<2	<4	2.7	<4	<40	<1	3.8	48	<2	<4	<1	<4
154835	0.7	<2	1.0	<2	<4	2.6	<4	<40	<1	3.2	26	4	<4	<1	<4
154841	0.5	2	2.0	<2	<4	5.5	<4	<40	<1	2.8	48	<2	<4	<1	<4
154847	1.1	<2	1.7	<2	<4	5.5	<4	44	<1	5.3	40	<2	<4	<1	<4
154848	0.7	<2	1.0	<2	<4	2.6	<4	<40	<1	1.3	23	<2	<4	<1	<4
154854	1.4	3	4.7	<2	<4	11.8	<4	<40	<1	4.9	65	8	<4	<1	<4
154855	1.0	3	2.9	<2	<4	7.8	<4	<40	<1	2.6	65	<2	<4	<1	<4
154858	1.0	4	3.6	<2	<4	10.1	<4	<40	<1	4.2	81	<2	<4	<1	<4
154860	0.3	<2	0.3	<2	5	1.2	<4	<40	<1	0.1	11	<2	<4	<1	<4
154863															
154865	0.8	<2	1.2	<2	<4	4.6	<4	<40	<1	5.4	35	<2	<4	<1	<4
154867	0.7	<2	0.8	<2	<4	2.5	<4	<40	<1	3.5	24	<2	<4	<1	14
154869	1.2	3	3.3	<2	<4	11.8	<4	<40	<1	8.3	63	<2	<4	<1	<4
154881	2.7	3	4.6	<2	<4	14.9	<4	<40	<1	8.3	77	<2	30	1	5
154891	0.6	<2	0.7	<2	<4	2.4	<4	<40	1	3.9	22	<2	8	1	<4
154893	2.7	7	6.2	<2	<4	19.6	<4	<40	1	15.0	171	<2	4	1	11

TABLE A-V. Analyses of water samples

b

RAFT RIVER WATER

OR SAMPLE NUMBER	ZR (PPB)	PH	BC (PPM)	AS (PPB)	SE (PPB)	SO4 (PPM)	CL (PPM)	T-AK (PPM)	BTDS	ATDS
154712	2	7.3		<0.5	<0.2	<5	<10		37.90	
154713	2			<0.5	<0.2	8	22		87.40	
154715	<2	7.2	49.41	<0.5	0.5	7	14	93	70.60	163.60
154717	<2	7.2	19.13	<0.5	0.6	<5	<10	36	24.50	60.50
154729										
154737	<2	7.0	63.28	0.7	0.5	13	35	128	142.70	270.70
154741	<2	8.0	101.82	0.6	0.5	12	82	171	222.00	353.00
154746	<2	7.1		0.7	0.5	7	35		106.70	
154756	<2	7.7	45.42	0.6	0.6	<5	42	78	115.00	193.00
154766	<2	8.4	55.94	0.5	0.5	<5	27	93	95.70	188.70
154768	<2	7.8	92.26	1.3	0.4	7	34	157	116.60	273.60
154771		7.6	53.54					93		
154772	<2	7.8	54.65	1.6	0.5	<5	15	93	67.20	160.20
154774	<2	7.8	66.99	0.6	0.5	7	40	114	131.50	245.50
154776	2	7.8	58.76	2.3	0.7	<5	25	100	92.20	192.20
154778	<2	7.6	73.69	0.7	0.6	<5	29	128	105.90	233.90
154782	<2	8.0	38.11	<0.5	<0.2	<5	17	64	65.50	129.50
154783	<2	6.8	28.49	1.6	<0.2	<5	31	64	121.40	185.40
154784	<2	8.0	59.55	1.2	<0.2	<5	23	100	90.20	190.20
154786	<2	7.9	135.11	1.4	<0.2	<5	42	235	177.10	412.10
154788	<2	8.0	110.16	0.6	<0.2	<5	39	185	152.00	337.00
154790	<2			<0.5	0.2	<5	<10		39.80	
154791	93			<0.5	0.2	<5	<10		120.70	
154793	<2			0.7	0.2	<5	13		32.60	
154797	4			<0.5	0.4	<5	<10		91.70	
154800	<2			1.6	<0.2	28	26		135.90	
154803	<2			<0.5	<0.2	<5	16		64.00	
154807	<2			<0.5	<0.2	<5	<10		25.10	
154809	<2			0.7	0.5	<5	16		89.60	
154810	3			<0.5	<0.2	<5	<10		41.70	
154811	<2			1.1	0.3	<5	51		145.10	
154813	<2			<0.5	0.2	<5	34		103.40	
154815	<2			<0.5	<0.2	<5	<10		20.80	
154817	<2			<0.5	0.3	28	77		227.10	
154819	<2			0.5	0.3	21	52		170.30	
154822	<2			<0.5	0.2	17	44		144.10	
154824	<2			<0.5	<0.2	<5	<10		16.90	
154826	<2			<0.5	<0.2	<5	<10		17.20	
154831	2			<0.5	<0.2	<5	<10		27.70	
154833	<2			<0.5	<0.2	<5	<10		45.40	
154835	<2			<0.5	<0.2	<5	<10		20.10	
154841	<2			<0.5	<0.2	<5	<10		28.70	
154847	<2			<0.5	<0.2	<5	<10		28.90	
154848	<2			<0.5	<0.2	<5	<10		18.60	
154854	<2			0.6	<0.2	<5	21		64.60	
154855	<2			<0.5	<0.2	<5	<10		34.80	
154858	<2			<0.5	<0.2	<5	11		46.70	
154860	<2			<0.5	0.3	<5	<10		12.50	
154863										
154865	2			<0.5	<0.2	<5	<10		25.60	
154867	<2			<0.5	<0.2	<5	<10		19.50	
154869	<2			<0.5	<0.2	<5	26		66.10	
154881	7			<0.5	0.4	<5	17		70.90	
154891	<2			<0.5	0.3	<5	<10		20.50	
154893	<2			<0.5	0.3	<5	29		105.80	

BTDS = Ca + K + Mg + Na + Si + SO_4 + Cl

ATDS = BTDS = total alkalinity

BC = bicarbonate anion

TABLE A-V. Analyses of water samples

RAFT RIVER WATER SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE ST	LAT	LONG	NUMBER L	TY	REP	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CO (PPB)	CR (PPB)	CU (PPB)	FE (PPB)
154902	40	-42.040	-113.678	-3-		-	21.32	3	29	81	115	1	59.3	2	<4	<2	<10
154908	40	-41.781	-113.818	-3-		-	14.17	2	24	14	36	1	27.8	<2	<4	<2	<10
154913	40	-41.659	-113.755	-3-		-	25.74	<2	17	36	33	1	22.7	2	<4	<2	<10
154915	40	-41.659	-113.750	-3-		-	23.61	<2	23	42	32	1	22.8	<2	<4	<2	<10
154917	40	-41.659	-113.750	-3-		-	6.85	3	15	36	37	1	18.8	<2	<4	<2	<10
154918	40	-41.659	-113.745	-3-	01	-	0.81	<2	37	25	34	1	18.1	<2	<4	2	216
154921	40	-41.651	-113.739	-3-	01	-	0.22	3	33	15	53	1	11.0	4	<4	<2	<10
154926	40	-42.299	-113.584	-3-	01	-	<0.20	4	28	<4	22	1	3.4	6	<4	3	<10
154927	40	-42.327	-113.599	-3-	01	-	<0.20	2	23	<4	14	1	2.9	2	<4	3	<10
156444	40	-42.043	-113.806	-3-		-	3.42	<2	12	10	34	<1	44.5	<2	<4	<2	<10
156452	40	-42.104	-113.864	-3-		-	1.09	<2	<10	20	25	<1	44.1	<2	<4	<2	<10
156454	40	-42.109	-113.855	-3-		-	2.72	<2	<10	23	31	<1	46.7	<2	<4	<2	<10
156455	40	-42.110	-113.877	-3-		-	1.34	<2	<10	25	41	<1	44.3	<2	<4	<2	<10
156461	40	-42.204	-113.722	-3-		-	0.45	<2	23	<4	20	<1	13.2	<2	<4	<2	<10
156463	40	-42.214	-113.715	-3-		-	<0.20	2	10	4	21	<1	16.2	6	6	<2	<10
156467	40	-******	-*******	-3-		-	0.51	<2	24	<4	17	<1	18.5	<2	<4	<2	<10
156474	40	-42.334	-113.702	-3-		-	0.84	<2	12	<4	13	<1	4.3	<2	<4	<2	<10
156475	40	-42.299	-113.709	-3-	01	-	0.78	<2	10	<4	25	<1	3.5	<2	<4	<2	<10
156476	40	-42.297	-113.706	-3-		-	0.77	<2	20	<4	19	<1	3.7	<2	<4	<2	<10
156477	40	-42.293	-113.671	-3-		-	28.20	2	<10	6	19	<1	18.8	5	4	<2	<10
156478	40	-42.279	-113.749	-3-		-	9.04	<2	53	11	37	<1	16.5	<2	<4	<2	33
156479	40	-42.279	-113.750	-3-		-	1.01	<2	11	<4	15	<1	15.6	<2	<4	<2	<10
156480	40	-42.436	-113.639	-3-	03	-	3.90	<2	<10	41	74	<1	50.0	<2	<4	<2	<10
156484	40	-42.395	-113.659	-3-		-	1.82	<2	<10	25	14	<1	56.3	3	<4	<2	<10
156486	40	-42.397	-113.666	-3-		-	0.98	<2	212	6	11	<1	4.5	2	<4	<2	112
156489	40	-42.362	-113.716	-3-	01	-	0.71	<2	<10	12	25	<1	10.3	<2	<4	<2	<10
156490	40	-42.359	-113.716	-3-		-	0.43	<2	45	<4	16	<1	6.5	2	<4	<2	16
156491	40	-42.338	-113.679	-3-		-	<0.20	<2	<10	13	29	<1	10.7	2	<4	<2	<10
156492	40	-42.339	-113.669	-3-	01	-	0.24	<2	10	20	28	<1	10.8	<2	<4	<2	<10
156493	40	-******	-*******	-3-		-	<0.20	2	14	4	14	<1	6.2	<2	<4	<2	<10
156495	40	-42.229	-113.597	-3-		-	<0.20	<2	38	<4	11	<1	4.7	<2	<4	<2	16
156496	40	-42.235	-113.624	-3-		-	1.33	<2	<10	9	20	<1	30.7	4	4	<2	<10
156497	40	-42.231	-113.613	-3-		-	1.42	<2	<10	7	19	<1	30.5	<2	<4	<2	<10
156498	40	-42.228	-113.611	-3-	01	-	0.36	<2	21	<4	10	<1	4.3	<2	<4	<2	<10
156499	40	-42.220	-113.609	-3-		-	<0.20	<2	42	<4	11	<1	4.5	<2	<4	<2	<10
156500	40	-42.208	-113.597	-3-		-	0.42	<2	760	12	23	<1	6.0	<2	<4	<2	396
156501	40	-42.209	-113.592	-3-		-	0.21	<2	11	11	33	<1	15.4	<2	<4	<2	<10
156502	40	-42.195	-113.601	-3-		-	0.28	<2	<10	18	37	<1	17.9	<2	<4	<2	<10
156503	40	-42.177	-113.609	-3-		-	<0.20	2	44	<4	12	<1	7.1	<2	4	<2	<10
156505	40	-42.144	-113.609	-3-		-	11.36	<2	<10	74	63	<1	73.5	<2	<4	<2	<10
156506	40	-42.101	-113.632	-3-		-	1.14	2	<10	24	20	<1	17.9	2	<4	<2	<10
156507	40	-42.116	-113.646	-3-		-	0.64	<2	10	<4	16	<1	6.9	<2	<4	<2	<10
156508	40	-42.108	-113.702	-3-		-	<0.20	<2	<10	8	14	<1	10.0	<2	<4	<2	<10
156509	40	-42.076	-113.679	-3-		-	3.22	<2	<10	75	95	<1	46.5	5	<4	<2	13
156512	40	-42.291	-113.674	-3-	01	-	0.30	2	<10	<4	18	<1	2.6	5	<4	<2	16
156513	40	-42.290	-113.679	-3-	01	-	0.61	<2	10	<4	10	<1	2.5	2	<4	<2	15
156514	40	-42.287	-113.666	-3-		-	0.30	2	54	<4	13	<1	3.4	4	<4	<2	51
156515	40	-42.281	-113.659	-3-		-	0.38	2	<10	<4	16	<1	5.7	5	<4	<2	20
156516	40	-42.277	-113.659	-3-		-	0.56	<2	<10	<4	15	<1	8.2	<2	<4	<2	21
156522	40	-42.051	-113.747	-3-	01	-	3.61	<2	<10	47	81	<1	43.4	<2	<4	<2	21
156530	40	-42.088	-113.734	-3-	01	-	2.53	2	15	18	32	<1	27.4	<2	<4	<2	<10
156531	40	-42.113	-113.728	-3-	01	-	0.37	<2	26	<4	6	<1	13.3	<2	<4	<2	<10
156533	40	-42.145	-113.731	-3-	01	-	0.38	<2	5441	<4	33	<1	4.3	<2	<4	<2	3165
156534	40	-42.155	-113.724	-3-		-	0.26	<2	136	<4	27	<1	10.5	<2	<4	<2	84
156536	40	-42.189	-113.694	-3-	01	-	0.64	<2	13	5	4	<1	5.3	<2	<4	<2	<10

TABLE A-V. Analyses of water samples

RAFT RIVER WATER — SECTION 2 OF 3

OR SAMPLE NUMBER	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)	Y (PPB)	ZN (PPB)
154902	2.8	20	14.7	<2	<4	75.0	<4	<40	<1	14.0	353	<2	13	1	<4
154908	2.1	6	6.5	<2	<4	10.9	<4	<40	1	6.5	164	<2	<4	<1	<4
154913	2.2	20	4.5	<2	<4	21.7	7	<40	1	9.9	114	<2	<4	<1	<4
154915	1.9	17	4.9	<2	<4	25.4	<4	<40	<1	9.5	115	<2	<4	<1	<4
154917	2.0	11	4.1	<2	<4	18.1	<4	<40	1	9.4	109	<2	<4	<1	<4
154918	1.8	4	3.5	<2	9	13.8	<4	<40	1	8.2	119	<2	<4	<1	15
154921	2.8	3	2.7	<2	<4	10.6	4	<40	<1	6.6	61	<2	5	<1	<4
154926	1.0	<2	0.8	<2	<4	2.6	<4	<40	1	2.3	21	<2	<4	<1	<4
154927	0.8	<2	0.7	<2	<4	1.5	<4	<40	1	2.3	17	<2	<4	<1	<4
156444	2.1	4	7.5	<2	<4	7.6	<4	<40	<1	12.9	143	<2	6	<1	<4
156452	1.8	7	4.7	<2	<4	10.9	<4	<40	<1	10.2	159	<2	<4	<1	7
156454	2.2	5	5.8	<2	<4	9.0	<4	<40	<1	10.8	149	<2	<4	<1	<4
156455	2.6	7	6.5	<2	<4	10.0	<4	<40	<1	12.3	153	<2	<4	<1	<4
156461	1.9	<2	1.9	<2	<4	3.8	<4	<40	<1	5.2	46	<2	4	<1	<4
156463	3.0	2	2.9	<2	<4	4.6	<4	<40	<1	5.1	45	<2	6	1	<4
156467	2.3	3	4.7	<2	<4	5.5	<4	<40	<1	5.7	59	<2	<4	<1	4
156474	0.7	<2	1.0	<2	<4	2.7	<4	<40	<1	1.8	24	<2	<4	<1	<4
156475	0.8	<2	0.8	<2	<4	3.0	<4	<40	<1	1.1	23	<2	<4	<1	<4
156476	0.7	<2	0.9	<2	<4	3.2	<4	<40	<1	2.3	25	<2	<4	<1	<4
156477	2.5	3	3.0	<2	10	9.8	<4	<40	<1	4.9	77	<2	<4	1	<4
156478	2.7	11	4.4	<2	<4	17.9	<4	<40	<1	14.3	58	2	<4	<1	<4
156479	0.7	<2	1.8	<2	<4	2.6	<4	<40	<1	2.0	52	<2	<4	<1	<4
156480	3.6	7	14.6	8	6	20.8	<4	<40	<1	19.6	210	<2	<4	<1	1162
156484	3.5	3	7.5	<2	<4	16.3	<4	<40	<1	8.0	57	<2	<4	<1	<4
156486	0.8	2	1.3	<2	<4	4.4	<4	<40	<1	4.8	25	6	<4	1	<4
156489	0.9	2	2.7	<2	<4	9.5	<4	<40	<1	3.3	54	<2	<4	<1	<4
156490	0.7	2	1.6	<2	<4	5.1	<4	<40	<1	2.7	34	2	<4	<1	<4
156491	1.2	2	2.9	<2	<4	15.4	<4	<40	<1	4.0	66	2	<4	<1	<4
156492	1.0	3	3.3	<2	6	17.5	<4	<40	1	3.2	69	2	<4	<1	<4
156493	1.3	3	1.9	<2	<4	6.8	<4	<40	<1	5.7	39	2	4	<1	<4
156495	0.7	<2	1.1	<2	<4	3.9	<4	<40	1	3.6	31	2	<4	<1	<4
156496	1.3	2	3.7	<2	<4	6.2	4	<40	<1	5.8	106	<2	<4	1	<4
156497	1.3	2	3.8	<2	8	6.5	<4	<40	<1	5.9	106	<2	<4	<1	<4
156498	0.7	<2	1.0	<2	<4	3.6	<4	<40	<1	3.4	29	<2	<4	<1	<4
156499	0.6	<2	1.1	<2	<4	4.1	<4	<40	<1	3.7	29	<2	<4	<1	<4
156500	0.9	2	1.6	2	<4	7.1	<4	<40	<1	5.5	41	22	<4	<1	<4
156501	1.4	3	3.6	<2	<4	13.6	4	<40	<1	4.6	78	<2	<4	<1	<4
156502	1.4	4	4.1	<2	<4	14.7	10	<40	<1	5.0	94	<2	<4	<1	<4
155503	1.0	2	1.7	<2	<4	7.4	<4	<40	<1	6.3	45	<2	7	1	<4
156505	3.2	23	16.7	<2	4	31.1	<4	<40	<1	15.3	479	<2	<4	<1	<4
156506	1.5	5	4.0	<2	<4	10.6	<4	<40	<1	4.1	106	<2	<4	<1	<4
156507	1.0	2	1.3	<2	<4	3.9	4	<40	<1	1.4	43	<2	<4	<1	<4
156508	0.9	3	2.0	<2	<4	8.4	<4	<40	<1	10.0	64	<2	<4	<1	<4
156509	3.5	21	10.8	<2	4	37.1	<4	105	<1	15.1	256	<2	4	<1	<4
156512	0.5	<2	0.7	2	<4	1.1	5	<40	<1	<0.1	19	<2	4	1	6
156513	0.9	<2	0.8	<2	<4	2.0	<4	<40	<1	1.6	16	<2	<4	<1	7
156514	0.8	<2	0.9	<2	<4	2.3	<4	<40	<1	2.3	22	<2	<4	<1	17
156515	0.8	2	1.8	<2	<4	3.6	<4	<40	<1	3.8	31	<2	<4	<1	15
156516	1.0	<2	1.9	<2	<4	2.6	<4	<40	<1	2.1	39	<2	<4	<1	<4
156522	2.7	13	9.2	<2	5	43.9	<4	<40	<1	16.3	285	<2	<4	<1	4
156530	2.1	8	7.2	<2	<4	15.3	<4	<40	<1	12.1	154	<2	<4	1	<4
156531	0.8	2	2.9	<2	<4	3.6	<4	<40	<1	4.7	43	<2	6	<1	<4
156533	1.0	5	1.8	18	<4	2.4	7	<40	1	13.1	31	187	<4	1	14
156534	1.3	3	2.5	<2	<4	6.3	5	<40	<1	8.2	62	3	<4	<1	36
156536	0.8	3	1.1	<2	<4	6.0	12	<40	<1	7.5	38	<2	<4	1	20

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

OR SAMPLE NUMBER	ZR (PPB)	PH	BC (PPM)	AS (PPB)	SE (PPB)	SO4 (PPM)	CL (PPM)	T-AK (PPM)	BTDS	ATDS
154902	<2			2.3	0.7	23	111		300.80	
154908	<2			0.6	0.6	11	13		78.80	
154913	<2			<0.5	0.4	7	25		94.00	
154915	<2			<0.5	0.5	8	26		99.50	
154917	<2			<0.5	0.4	<5	17		72.90	
154918	<2			<0.5	0.4	5	11		62.40	
154921	<2			<0.5	0.3	<5	13		50.20	
154926	<2			<0.5	0.3	<5	<10		18.60	
154927	<2			<0.5	0.3	<5	<10		16.70	
156444	2	8.1		<0.5	0.5	<5	<10		83.10	
156452	<2	7.8		0.5	0.5	<5	<10		80.20	
156454	<2	7.7		0.5	0.6	<5	10		88.00	
156455	<2	8.1		1.0	0.5	<5	10		89.20	
156461	<2	7.0		<0.5	0.5	<5	<10		34.60	
156463	3	6.4		<0.5	0.6	<5	<10		40.30	
156467	<2			<0.5	0.5	<5	<10		45.20	
156474	<2	7.1	10.80	<0.5	<0.2	<5	<10	21	19.00	40.00
156475	<2	6.8	9.35	<0.5	<0.2	<5	<10	21	17.70	38.70
156476	<2	7.1	10.80	<0.5	<0.2	<5	<10	21	19.30	40.30
156477	<2	8.1	34.10	<0.5	<0.2	6	12	57	58.00	115.00
156478	<2	7.4	27.88	<0.5	<0.2	<5	12	50	71.30	121.30
156479	<2	7.6	28.78	<0.5	<0.2	<5	<10	50	31.20	81.20
156480	<2			1.1	<0.2	6	30		145.60	
156484	<2			<0.5	0.2	<5	16		111.10	
156486	2			<0.5	<0.2	<5	<10		24.30	
156489	<2	6.7	14.98	<0.5	<0.2	<5	<10	36	35.20	71.20
156490	<2	6.8	12.91	<0.5	<0.2	<5	<10	29	25.10	54.10
156491	<2	6.6	13.85	<0.5	<0.2	<5	13	36	50.70	86.70
156492	<2	7.0	21.26	<0.5	<0.2	<5	14	43	53.30	96.30
156493	<2	7.2	15.41	<0.5	<0.2	<5	<10	29	30.40	59.40
156495	<2			<0.5	<0.2	<5	<10		22.50	
156496	3			<0.5	<0.2	<5	<10		56.20	
156497	<2			<0.5	<0.2	<5	<10		56.50	
156498	<2	7.0	14.34	<0.5	<0.2	<5	<10	29	21.50	50.50
156499	<2			<0.5	<0.2	<5	<10		22.50	
156500	<2			<0.5	0.3	<5	<10		29.60	
156501	2			<0.5	<0.2	<5	18		60.10	
156502	<2			<0.1	<0.1					
156503	3			<0.5	<0.2	<5	<10		32.00	
156505	<2			0.9	<0.2	<5	20		165.40	
156506	<2			<0.5	<0.2	<5	<10		46.60	
156507	<2			<0.5	<0.2	<5	<10		23.00	
156508	<2			<0.5	<0.2	<5	<10		39.80	
156509	3			1.9	0.4	15	34		163.00	
156512	<2			<0.5	<0.2	<5	<10		13.45	
156513	<2			<0.5	<0.2	<5	<10		16.60	
156514	<2			<0.5	<0.2	<5	<10		18.20	
156515	2			<0.5	<0.2	<5	<10		24.20	
156516	<2			<0.5	<0.2	<5	<10		24.30	
156522	<2			0.7	<0.2	8	56		180.50	
156530	2			<0.5	<0.2	<5	<10		73.60	
156531	<2			<0.5	<0.2	<5	<10		33.80	
156533	3			<0.5	<0.2	<5	<10		31.10	
156534	<2			<0.5	0.4	<5	<10		37.30	
156536	2			<0.5	<0.2	<5	<10		29.20	

BTDS = Ca + K + Mg + Na + Si + SO_4 + Cl

ATDS = BTDS + total alkalinity

BC = bicarbonate anion

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CO (PPB)	CR (PPB)	CU (PPB)	FE (PPB)
156542	40-42.135	-113.749	-3- -	0.59	2	<10	9	38	<1	26.6	<2	<4	<2	<10
156543	40-42.242	-113.713	-3-01-	2.50	2	<10	9	20	5	63.0	4	7	<2	<10
156544	40-42.234	-113.700	-3-01-	0.66	<2	217	7	22	3	5.1	4	4	2	111
156545	40-42.141	-113.681	-3- -	0.64	<2	18	<4	15	<1	2.9	<2	<4	<2	<10
156547	40-42.226	-113.656	-3- -	0.51	<2	18	<4	13	<1	2.9	<2	<4	<2	<10
156548	40-42.227	-113.654	-3-01-	0.21	<2	10	7	17	<1	5.3	<2	<4	<2	<10
156550	40-42.245	-113.656	-3-01-	0.51	<2	16	18	25	<1	14.5	<2	<4	<2	<10
156551	40-42.239	-113.670	-3- -	0.37	3	14	4	12	<1	4.4	<2	<4	<2	<10
156553	40-42.239	-113.669	-3- -	0.49	<2	24	6	17	<1	8.0	<2	<4	<2	<10
156555	40-42.252	-113.655	-3- -	0.20	<2	23	<4	14	<1	5.4	<2	<4	<2	<10
156558	40-42.256	-113.676	-3- -	0.20	<2	<10	13	32	<1	45.7	<2	<4	<2	<10
156559	40-42.266	-113.677	-3- -	0.87	<2	<10	<4	15	<1	58.6	<2	<4	<2	12
156561	40-42.273	-113.690	-3-01-	1.12	2	<10	4	13	<1	69.4	3	<4	<2	16
156563	40-42.279	-113.631	-3-01-	0.67	<2	124	<4	21	<1	17.8	2	<4	<2	81
156565	40-42.282	-113.632	-3- -	0.39	<2	<10	<4	13	<1	11.1	4	<4	<2	16
156566	40-42.294	-113.652	-3-01-	0.53	<2	<10	<4	11	<1	1.7	<2	<4	<2	13
156567	40-42.294	-113.646	-3-01-	0.53	2	13	<4	12	<1	7.5	4	<4	<2	11
156570	40-42.262	-113.630	-3- -	0.71	<2	<10	5	13	<1	24.5	<2	<4	<2	34
156571	40-42.256	-113.652	-3-01-	0.95	<2	<10	12	12	<1	78.3	<2	<4	<2	32
156572	40-42.243	-113.698	-3-01-	0.26	<2	22	10	13	<1	13.5	<2	<4	<2	370
156574	40-42.084	-113.754	-3- -	0.88	3	20	27	41	<1	31.9	<2	6	<2	37
156577	40-42.049	-113.755	-3- -	2.37	<2	<10	52	67	<1	42.1	<2	5	<2	45
156582	40-41.998	-113.726	-3-01-	12.52	<2	<10	116	50	<1	81.5	2	<4	<2	34
156595	40-41.915	-113.660	-3- -	0.54	<2	<10	34	22	<1	30.8	2	<4	<2	38
156596	40-41.903	-113.669	-3-01-	<0.20	<2	13	8	5	<1	8.9	2	<4	<2	40
156597	40-41.911	-113.633	-3- -	4.01	<2	<10	29	24	<1	53.6	3	<4	<2	35
156599	40-41.904	-113.636	-3-01-	1.31	<2	<10	35	2	<1	43.0	<2	<4	<2	31
156600	40-41.902	-113.658	-3-01-	0.44	<2	10	17	25	<1	12.3	<2	<4	<2	30
156604	40-41.892	-113.654	-3- -	1.46	2	<10	39	54	<1	36.0	3	<4	<2	43
156607	40-41.869	-113.660	-3- -	0.36	<2	<10	47	28	<1	49.1	<2	<4	<2	37
156608	40-41.867	-113.660	-3- -	1.41	<2	<10	36	22	<1	53.3	<2	<4	<2	33
156610	40-41.861	-113.660	-3- -	0.65	2	<10	82	68	<1	68.6	<2	4	<2	35
156611	40-41.829	-113.654	-3-01-	0.77	<2	<10	19	13	<1	53.4	2	<4	<2	31
156612	40-41.927	-113.579	-3-01-	1.48	3	<10	41	16	<1	80.2	3	5	<2	30
156615	40-41.906	-113.562	-3- -	2.06	<2	<10	44	17	<1	69.3	<2	<4	<2	28
156617	40-41.888	-113.548	-3- -	1.93	<2	<10	29	12	<1	27.0	<2	<4	<2	28
156618	40-41.873	-113.577	-3-01-	0.99	<2	<10	35	24	<1	51.1	<2	<4	<2	38
156619	40-41.873	-113.580	-3-01-	2.00	<2	<10	37	12	<1	64.4	<2	<4	<2	33
156620	40-41.877	-113.551	-3- -	1.23	2	<10	36	16	<1	31.1	<2	5	<2	35
156621	40-41.878	-113.553	-3-01-	1.33	3	<10	23	12	<1	47.1	<2	<4	<2	29
156623	40-41.887	-113.524	-3- -	2.20	<2	23	10	13	<1	15.6	<2	<4	<2	69
156625	40-41.891	-113.524	-3- -	1.71	<2	<10	32	19	<1	46.8	3	<4	<2	61
156626	40-41.887	-113.534	-3- -	2.54	2	<10	22	15	<1	22.6	<2	4	<2	72
156627	40-41.895	-113.553	-3- -	2.92	<2	<10	24	18	<1	33.0	<2	<4	<2	63
156629	40-41.921	-113.529	-3-01-	8.83	3	<10	70	20	<1	86.7	3	<4	<2	57
156631	40-41.902	-113.507	-3- -	1.82	5	<10	14	20	<1	62.3	5	5	<2	57
156632	40-41.909	-113.515	-3- -	1.57	2	<10	22	24	<1	45.9	2	<4	<2	60
156633	40-41.931	-113.536	-3- -	0.93	<2	<10	58	22	<1	59.7	2	<4	<2	55
156638	40-41.917	-113.466	-3- -	0.62	<2	<10	<4	10	<1	16.9	<2	<4	<2	77
156639	40-41.936	-113.516	-3- -	0.93	<2	<10	9	16	<1	27.3	2	<4	<2	58
156641	40-41.936	-113.516	-3-01-	5.16	<2	<10	41	21	<1	77.8	2	<4	126	52
156642	40-41.936	-113.516	-3-01-	2.63	<2	<10	37	23	<1	52.1	<2	<4	<2	56
156643	40-******	-********	-3- -	2.67	3	<10	53	51	<1	56.5	<2	<4	<2	64
156648	40-41.906	-113.695	-3-01-	1.33	<2	<10	51	24	<1	43.2	<2	<4	<2	53
156649	40-41.897	-113.706	-3-01-	2.35	4	<10	45	8	<1	48.8	2	4	<2	55

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

SECTION 2 OF 3

OR SAMPLE NUMBER	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)	Y (PPB)	ZN (PPB)
156542	1.7	3	4.5	<2	<4	6.2	8	<40	<1	6.9	120	<2	<4	<1	<4
156543	2.4	7	5.6	4	14	7.9	<4	<40	3	5.5	188	4	4	5	<4
156544	1.5	4	1.5	3	<4	4.1	5	<40	2	4.2	32	11	4	3	<4
156545	0.5	<2	0.7	<2	<4	2.1	<4	<40	<1	2.9	23	<2	<4	<1	<4
156547	0.5	<2	0.6	<2	<4	2.3	<4	<40	<1	3.1	22	<2	<4	<1	<4
156548	0.7	2	1.3	<2	<4	3.5	<4	<40	<1	3.7	36	<2	<4	<1	<4
156550	1.3	3	4.0	<2	<4	13.6	<4	57	<1	6.9	78	<2	<4	<1	<4
156551	0.8	<2	1.0	<2	<4	3.0	<4	<40	<1	3.5	31	<2	<4	1	<4
156553	1.1	2	2.0	<2	<4	6.9	<4	<40	<1	4.7	50	<2	<4	<1	12
156555	0.9	2	1.2	<2	<4	3.9	<4	<40	<1	3.9	36	<2	<4	<1	<4
156558	2.1	3	6.3	<2	<4	9.4	<4	<40	<1	8.0	169	<2	<4	<1	<4
156559	1.1	2	3.6	<2	<4	5.2	<4	<40	<1	4.0	108	<2	<4	<1	<4
156561	0.6	2	2.5	<2	13	5.0	<4	<40	<1	3.0	57	<2	<4	<1	<4
156563	1.3	<2	2.9	<2	8	3.6	<4	<40	<1	3.2	72	5	<4	<1	<4
156565	1.0	2	1.8	<2	<4	3.4	8	<40	1	2.8	86	<2	<4	<1	<4
156566	0.3	<2	0.5	<2	<4	1.4	<4	<40	<1	0.7	12	<2	<4	<1	<4
156567	0.4	<2	0.9	<2	<4	1.5	<4	<40	<1	1.1	27	<2	<4	<1	<4
156570	2.9	2	3.6	<2	9	2.8	<4	<40	<1	3.1	82	<2	<4	<1	<4
156571	0.6	3	1.7	<2	10	4.8	<4	<40	<1	2.9	384	<2	<4	<1	<4
156572	5.7	2	3.0	621	<4	4.6	<4	47	<1	6.1	77	<2	<4	<1	<4
156574	3.8	7	6.8	<2	10	16.7	6	67	<1	13.5	187	<2	<4	1	<4
156577	4.8	10	8.6	2	<4	30.4	<4	40	<1	13.8	267	<2	6	1	<4
156582	4.4	20	20.7	<2	7	57.0	<4	<40	<1	18.3	459	<2	<4	<1	6
156595	3.7	9	9.3	<2	6	21.5	<4	90	<1	8.4	159	<2	<4	<1	<4
156596	0.5	2	2.5	<2	<4	6.6	<4	<40	<1	4.3	45	<2	<4	<1	<4
156597	2.5	7	8.8	2	12	18.3	<4	<40	<1	6.9	242	<2	<4	<1	<4
156599	1.0	10	11.1	<2	4	23.9	<4	<40	<1	6.5	186	<2	<4	<1	<4
156600	0.7	4	3.3	2	<4	14.7	<4	<40	<1	9.7	70	<2	<4	<1	<4
156604	4.3	10	8.1	<2	<4	22.6	<4	<40	<1	16.0	207	<2	5	1	<4
156607	1.8	8	5.6	<2	<4	22.2	<4	123	<1	12.8	152	<2	<4	<1	<4
156608	0.9	7	6.2	<2	<4	21.4	<4	<40	<1	9.0	157	<2	<4	<1	<4
156610	2.5	16	12.8	<2	<4	42.8	<4	76	<1	13.2	345	<2	<4	1	<4
156611	0.8	4	7.6	<2	<4	14.8	<4	<40	<1	4.8	140	<2	<4	<1	<4
156612	1.6	9	8.6	<2	9	25.2	<4	<40	<1	4.8	313	<2	4	1	<4
156615	2.3	7	5.7	<2	52	35.3	<4	<40	<1	6.3	282	<2	<4	<1	<4
156617	1.8	5	5.7	<2	<4	21.6	<4	<40	<1	5.2	134	<2	<4	<1	<4
156618	2.5	5	6.6	4	<4	18.8	<4	<40	<1	6.6	182	<2	<4	<1	<4
156619	3.5	6	9.6	<2	<4	23.9	<4	<40	<1	5.8	219	<2	<4	<1	<4
156620	1.9	6	6.7	<2	<4	25.9	<4	<40	<1	6.5	152	<2	<4	1	<4
156621	2.0	4	6.8	<2	<4	19.5	<4	<40	<1	5.9	182	<2	<4	1	<4
156623	1.4	4	3.8	<2	<4	14.5	<4	<40	<1	4.7	92	<2	<4	<1	13
156625	1.8	6	9.2	<2	6	25.4	<4	<40	<1	4.8	210	<2	<4	<1	<4
156626	1.6	4	4.7	<2	<4	16.4	4	<40	<1	4.8	123	<2	<4	1	<4
156627	2.2	6	6.6	<2	<4	23.1	<4	<40	<1	5.5	157	<2	<4	<1	<4
156629	1.6	13	19.5	<2	6	70.1	<4	<40	<1	4.4	389	<2	<4	1	<4
156631	1.8	5	10.5	<2	7	14.7	5	<40	<1	2.9	247	<2	<4	2	4
156632	1.7	6	9.7	<2	4	16.5	<4	<40	<1	6.1	172	<2	<4	<1	<4
156633	1.7	13	14.1	<2	4	42.2	<4	<40	<1	5.8	309	<2	<4	<1	<4
156638	0.9	2	3.4	<2	<4	7.7	<4	<40	<1	2.5	74	<2	<4	<1	<4
156639	1.3	4	5.8	<2	<4	11.6	<4	<40	<1	2.7	140	<2	<4	<1	<4
156641	1.4	11	28.2	<2	<4	69.1	<4	<40	<1	2.2	762	<2	<4	<1	15
156642	1.9	9	12.6	<2	<4	33.5	<4	<40	<1	3.2	337	<2	<4	<1	<4
156643	3.2	12	9.7	<2	<4	35.5	<4	<40	<1	13.6	257	<2	<4	1	<4
156648	1.9	13	12.9	<2	<4	34.0	<4	<40	<1	11.2	200	<2	<4	<1	<4
156649	2.0	13	15.0	<2	9	32.5	<4	<40	<1	6.2	182	<2	8	1	7

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

DR SAMPLE NUMBER	ZR (PPB)	PH	EC (PPM)	AS (PPB)	SE (PPB)	SO4 (PPM)	CL (PPM)	T-AK (PPM)	BTDS	ATDS
156542	<2			<0.5	0.4	<5	<10		54.40	
156543	2			<0.5	0.4	<5	<10		92.90	
156544	3			<0.5	<0.2	<5	<10		24.90	
156545	<2			<0.5	0.2	<5	<10		17.60	
156547	<2			<0.5	0.3	<5	<10		17.90	
156548	<2			<0.5	<0.2	<5	<10		23.00	
156550	<2			<0.5	<0.2	<5	<10		48.80	
156551	<2			<0.5	0.4	<5	<10		21.20	
156553	<2			<0.5	<0.2	<5	<10		31.20	
156555	<2			<0.5	<0.2	<5	<10		23.80	
156558	<2			<0.5	0.3	<5	<10		80.00	
156559	<2			<0.5	<0.2	<5	<10		81.00	
156561	2			<0.5	<0.2	<5	<10		89.00	
156563	<2			<0.5	<0.2	<5	<10		37.30	
156565	<2			<0.5	<0.2	<5	<10		28.60	
156566	<2			<0.5	<0.2	<5	<10		13.10	
156567	<2			<0.5	<0.2	<5	<10		19.90	
156570	<2			<0.5	<0.2	<5	<10		45.40	
156571	<2			<0.5	0.3	<5	<10		96.80	
156572	<2			<0.5	<0.2	7	<10		45.50	
156574	4			<0.5	<0.2	11	43		127.70	
156577	<2			1.0	0.3	22	69		191.70	
156582	<2			1.4	<0.2	32	167		381.90	
156595	<2			<0.5	<0.2	10	69		153.70	
156596	<2			<0.5	<0.2	7	14		44.80	
156597	<2			<0.5	<0.2	18	34		143.10	
156599	<2			<0.5	<0.2	13	76		175.50	
156600	<2			<0.5	<0.2	6	27		74.70	
156604	<2			0.5	0.3	10	77		175.00	
156607	<2			0.5	0.3	8	48		148.50	
156608	<2			0.5	<0.2	8	54		153.80	
156610	<2			0.5	<0.2	9	116		265.90	
156611	2			<0.5	<0.2	<5	48		132.90	
156612	2			<0.5	0.3	8	71		200.40	
156615	<2			<0.5	<0.2	26	66		215.90	
156617	<2			<0.5	<0.2	8	34		104.30	
156618	<2			<0.5	<0.2	13	24		123.60	
156619	<2			0.6	0.8	18	44		170.20	
156620	<2			0.7	<0.2	12	41		126.10	
156621	<2			<0.5	<0.2	16	36		134.30	
156623	<2			0.8	0.6	<5	22		65.50	
156625	<2			<0.5	0.3	14	33		136.00	
156626	<2			<0.5	<0.2	<5	29		82.60	
156627	<2			<0.5	<0.2	8	40		119.40	
156629	<2			<0.5	<0.2	85	148		416.30	
156631	5			<0.5	<0.2	<5	13		108.70	
156632	2			<0.5	0.3	<5	32		115.40	
156633	<2			<0.5	0.3	23	73		220.50	
156638	<2			<0.5	<0.2	6	<10		43.40	
156639	<2			<0.5	<0.2	6	20		75.70	
156641	2			<0.5	<0.2	59	169		407.70	
156642	<2			<0.5	<0.2	23	68		195.30	
156643	4			<0.5	<0.2	8	78		205.50	
156648	<2			<0.5	<0.2	24	84		212.20	
156649	3			<0.5	<0.2	36	92		233.50	

BTDS = Ca + K + Mg + Na + Si + SO_4 + Cl

ATDS = BTDS + total alkalinity

BC = bicarbonate anion

TABLE A-V. Analyses of water samples

RAFT RIVER WATER OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CO (PPB)	CR (PPB)	CU (PPB)	FE (PPB)
156652	40	-41.884	-113.685	-3-01-	1.47	4	<10	46	13	<1	34.0	<2	10	<2	52
156657	40	-41.849	-113.673	-3-01-	0.46	<2	<10	17	12	<1	15.4	2	<4	<2	50
156660	40	-41.852	-113.590	-3- -	0.50	<2	<10	50	25	<1	44.6	<2	<4	<2	47
156664	40	-41.893	-113.596	-3-01-	1.26	<2	<10	14	6	<1	56.1	2	<4	<2	49
156667	40	-41.889	-113.609	-3- -	1.20	<2	<10	13	10	<1	62.5	<2	<4	<2	44
156668	40	-41.883	-113.612	-3- -	1.67	2	<10	41	17	<1	41.5	2	<4	<2	50
156669	40	-41.891	-113.621	-3- -	0.99	<2	<10	48	38	<1	54.2	<2	<4	<2	51
156670	40	-41.885	-113.627	-3-01-	<0.20	<2	<10	29	21	<1	15.3	<2	<4	<2	115
156671	40	-41.879	-113.643	-3-01-	0.87	<2	<10	8	4	<1	59.4	<2	<4	<2	47
156674	40	-41.939	-113.697	-3-01-	6.98	<2	<10	75	16	<1	65.8	2	<4	<2	55
156677	40	-41.934	-113.696	-3-01-	3.49	4	<10	45	10	<1	55.2	2	8	<2	55
156685	40	-41.853	-113.787	-3-01-	1.07	3	<10	12	142	<1	61.6	<2	7	<2	53
156686	40	-41.861	-113.799	-3-01-	1.39	4	<10	<4	122	7	6.0	52	183	30	<10
156687	40	-41.864	-113.799	-3- -	2.05	<2	<10	24	68	<1	69.5	<2	<4	<2	65
156690	40	-41.891	-113.809	-3- -	0.75	<2	<10	22	17	<1	35.3	<2	<4	<2	50
156692	40	-41.903	-113.811	-3-01-	0.62	<2	<10	26	21	<1	31.4	<2	<4	<2	56
156695	40	-41.886	-113.795	-3- -	4.60	2	<10	33	37	<1	23.4	<2	<4	<2	56
156696	40	-41.898	-113.794	-3-01-	1.63	<2	<10	16	16	<1	12.3	<2	<4	<2	50
156703	40	-41.997	-113.528	-3-01-	13.93	<2	<10	111	56	<1	78.5	<2	<4	<2	47
156711	40	-42.172	-113.655	-3-01-	0.48	2	<10	<4	2	<1	3.1	5	<4	<2	47
156713	40	-42.175	-113.636	-3- -	0.95	2	10	<4	5	<1	7.0	<2	<4	<2	48
156718	40	-42.199	-113.696	-3-01-	0.52	<2	42	<4	15	<1	11.4	<2	<4	<2	120
156723	40	-42.196	-113.692	-3- -	0.50	3	<10	<4	7	<1	3.5	2	<4	<2	46
156725	40	-42.196	-113.692	-3- -	0.50	2	<10	<4	3	<1	2.3	2	<4	<2	44
156732	40	-42.375	-113.637	-3- -	0.60	<2	<10	<4	5	<1	32.2	<2	<4	<2	41
156733	40	-42.375	-113.637	-3- -	0.45	2	<10	<4	17	<1	5.5	7	4	<2	44
156736	40	-42.343	-113.560	-3- -	0.56	3	<10	<4	9	<1	5.6	2	5	<2	55
156744	40	-42.078	-113.821	-3-01-	2.19	<2	55	<4	14	1	58.5	<2	<4	<2	<10
156746	40	-42.009	-113.803	-3-03-	3.06	4	12	33	33	1	45.6	<2	<4	<2	<10
156748	40	-42.032	-113.803	-3- -	2.19	<2	26	12	49	1	41.2	<2	<4	<2	<10
156753	40	-42.109	-113.777	-3- -	2.33	3	13	41	72	1	51.8	<2	<4	<2	<10
156755	40	-42.139	-113.792	-3- -	4.34	3	<10	77	124	1	74.9	2	<4	<2	<10
156757	40	-42.150	-113.798	-3- -	3.27	2	16	50	68	1	57.2	3	<4	<2	<10
156759	40	-42.162	-113.804	-3- -	2.48	<2	14	34	59	1	46.2	<2	<4	<2	<10
156762	40	-42.160	-113.759	-3- -	1.54	<2	34	<4	7	1	18.0	<2	<4	2	<10
156764	40	-42.194	-113.754	-3- -	0.59	2	23	7	16	1	17.6	4	<4	2	<10
156766	40	-42.194	-113.743	-3- -	2.49	2	45	<4	11	1	23.0	3	<4	<2	<10
156770	40	-42.323	-113.588	-3-01-	0.26	4	22	<4	9	1	2.3	3	<4	2	<10
156780	40	-42.315	-113.634	-3-01-	0.27	2	10	<4	12	1	39.0	4	<4	<2	<10
156786	40	-41.679	-113.739	-3-01-	0.50	3	22	12	3	<1	4.3	3	<4	<2	14
156788	40	-42.302	-113.634	-3- -	0.29	2	24	<4	15	1	15.8	<2	<4	<2	<10
156793	40	-41.954	-113.317	-3- -	5.08	2	<10	15	11	<1	17.4	2	5	<2	48
156795	40	-41.956	-113.309	-3- -	4.09	4	<10	9	13	1	15.5	2	7	<2	69
156797	40	-42.102	-113.729	-3-01-	1.64	6	44	13	43	1	11.7	5	<4	<2	<10
156799	40	-42.086	-113.744	-3- -	4.44	3	98	26	70	1	36.2	2	<4	<2	<10
156811	40	-41.627	-113.692	-3- -	11.21	<2	15	29	102	1	53.5	<2	<4	<2	<10
156820	40	-42.355	-113.619	-3-01-	0.70	<2	<10	<4	14	<1	9.6	<2	<4	<2	41
156822	40	-42.359	-113.625	-3- -	<0.20	<2	14	9	13	<1	6.0	<2	<4	<2	48
156823	40	-42.363	-113.617	-3- -	0.57	<2	<10	<4	12	<1	6.8	2	<4	<2	41
156826	40	-42.372	-113.614	-3-01-	0.59	<2	<10	<4	9	<1	8.2	3	<4	<2	49
156829	40	-41.839	-113.801	-3- -	1.72	<2	<10	52	70	<1	70.1	<2	<4	<2	67
156831	40	-41.827	-113.651	-3- -	7.69	3	<10	19	16	<1	24.4	<2	<4	<2	46
156833	40	-41.816	-113.775	-3-01-	0.93	<2	441	18	17	<1	8.5	<2	<4	<2	260
156838	40	-41.861	-113.770	-3- -	6.73	<2	<10	13	16	<1	23.8	<2	<4	<2	47
156841	40	-42.166	-113.715	-3- -	<0.20	<2	<10	<4	4	<1	2.1	<2	<4	<2	41

TABLE A-V. Analyses of water samples

RAFT RIVER WATER — SECTION 2 OF 3

OR SAMPLE NUMBER	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)	Y (PPB)	ZN (PPB)
156652	1.6	10	10.1	<2	<4	32.8	<4	<40	<1	7.9	146	<2	7	1	7
156657	1.8	4	3.8	<2	<4	18.0	<4	<40	<1	3.0	73	<2	<4	1	<4
156660	2.3	8	6.6	<2	8	29.9	4	40	<1	5.9	174	<2	<4	<1	<4
156664	1.0	4	6.2	<2	4	17.5	<4	<40	<1	3.7	158	<2	<4	<1	<4
156667	0.9	4	5.4	<2	<4	17.4	<4	<40	<1	5.7	174	<2	<4	<1	<4
156668	1.5	6	6.3	<2	5	28.5	<4	<40	<1	6.4	186	<2	<4	<1	<4
156669	2.9	11	8.9	<2	<4	31.5	<4	<40	<1	10.2	234	<2	<4	<1	<4
156670	3.8	7	4.0	5	<4	20.4	<4	964	<1	10.2	87	<2	<4	<1	<4
156671	0.6	4	4.7	<2	6	8.7	<4	<40	<1	3.2	163	<2	<4	<1	<4
156674	3.3	16	19.3	<2	<4	55.3	<4	<40	<1	5.0	345	<2	<4	<1	<4
156677	3.6	12	14.6	<2	<4	31.8	4	<40	<1	5.8	245	<2	11	1	<4
156685	0.8	5	10.0	<2	8	10.1	<4	<40	<1	3.7	209	<2	4	1	<4
156686	0.2	4	2.8	1019	5	1.7	80	359	22	0.3	289	4958	147	11	64
156687	2.4	9	7.2	<2	9	18.6	<4	<40	<1	11.0	326	<2	<4	1	<4
156690	1.9	6	7.4	<2	6	12.1	<4	46	<1	7.1	103	<2	<4	<1	<4
156692	1.8	4	5.1	<2	<4	13.0	<4	<40	<1	8.4	88	<2	<4	<1	<4
156695	7.9	11	5.6	<2	8	21.8	<4	<40	<1	5.1	134	<2	7	1	<4
156696	1.6	3	3.0	<2	<4	12.4	<4	<40	<1	10.5	68	<2	<4	<1	<4
156703	5.2	23	21.3	<2	6	70.8	<4	<40	<1	18.1	442	<2	<4	<1	31
156711	0.6	<2	0.7	<2	<4	3.1	<4	<40	<1	4.6	22	<2	<4	1	<4
156713	0.9	<2	1.3	<2	<4	4.9	<4	<40	<1	5.8	39	<2	5	1	<4
156718	2.2	<2	2.4	4	<4	3.7	<4	<40	<1	4.5	59	<2	<4	<1	<4
156723	0.8	<2	0.7	<2	<4	3.1	<4	<40	<1	4.6	24	<2	<4	1	<4
156725	0.5	<2	0.4	<2	<4	2.5	<4	<40	<1	4.0	16	<2	<4	1	<4
156732	0.7	<2	5.7	<2	<4	1.7	<4	<40	<1	1.5	84	<2	<4	<1	<4
156733	0.9	<2	1.3	<2	5	2.8	6	<40	<1	2.8	24	<2	5	1	<4
156736	1.0	<2	1.1	<2	5	2.8	<4	181	<1	2.0	26	<2	<4	<1	<4
156744	1.3	3	3.3	<2	<4	4.8	<4	<40	<1	8.4	157	<2	<4	<1	<4
156746	1.9	6	5.6	<2	<4	18.1	5	<40	<1	13.2	176	<2	<4	<1	<4
156748	2.6	6	7.0	<2	<4	10.5	6	<40	<1	12.7	150	<2	<4	<1	<4
156753	2.3	8	9.5	<2	<4	23.5	4	<40	1	18.4	233	<2	<4	<1	<4
156755	2.4	18	15.2	<2	<4	38.3	<4	<40	<1	20.2	396	<2	7	1	<4
156757	2.8	11	10.9	<2	<4	29.3	<4	<40	<1	16.0	307	<2	7	<1	<4
156759	2.8	7	8.5	<2	<4	20.5	<4	<40	<1	16.4	218	<2	<4	<1	<4
156762	1.8	5	3.4	<2	<4	7.2	<4	<40	1	10.0	70	<2	<4	<1	<4
156764	1.8	3	4.0	<2	<4	4.0	<4	<40	1	6.4	58	<2	4	<1	6
156766	2.6	3	5.1	<2	<4	4.1	<4	<40	1	7.2	65	<2	<4	<1	<4
156770	0.5	<2	0.4	<2	<4	0.8	<4	<40	1	1.3	12	<2	<4	1	<4
156780	0.7	<2	2.7	<2	4	1.9	4	<40	1	2.4	85	<2	<4	<1	<4
156786	0.9	<2	0.9	2	<4	4.3	<4	<40	<1	5.7	27	<2	6	1	5
156788	0.8	2	1.9	<2	<4	2.5	4	<40	1	3.3	48	<2	<4	<1	<4
156793	1.7	3	4.2	<2	<4	12.9	<4	<40	<1	2.8	83	<2	<4	1	<4
156795	1.3	4	3.8	<2	<4	12.2	<4	<40	<1	3.1	82	<2	8	1	<4
156797	1.0	7	1.9	<2	<4	11.2	4	<40	1	15.1	58	<2	8	1	<4
156799	3.8	9	7.8	<2	<4	20.9	<4	<40	1	14.4	208	<2	<4	<1	<4
156811	1.8	11	10.2	<2	<4	25.5	<4	<40	1	8.2	233	<2	<4	<1	<4
156820	1.0	<2	2.1	<2	<4	6.2	<4	<40	<1	1.7	37	<2	<4	<1	<4
156822	1.5	<2	1.7	<2	<4	8.5	<4	<40	<1	3.2	33	<2	<4	<1	<4
156823	1.0	<2	1.6	<2	<4	5.3	<4	<40	<1	2.4	31	<2	<4	<1	<4
156826	1.1	2	2.0	<2	<4	6.5	<4	<40	<1	4.0	36	<2	<4	1	<4
156829	7.7	14	27.3	266	14	29.4	6	<40	<1	10.8	331	<2	<4	<1	<4
156831	2.5	7	6.0	<2	<4	11.0	<4	<40	<1	8.3	104	<2	<4	<1	10
156833	1.0	5	1.9	<2	<4	7.8	<4	<40	<1	6.7	43	15	<4	<1	<4
156838	3.1	9	3.9	<2	7	12.3	<4	<40	<1	12.7	54	<2	<4	<1	<4
156841	0.4	<2	0.4	<2	<4	1.9	<4	<40	<1	3.2	18	<2	<4	<1	<4

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

OR SAMPLE NUMBER	ZR (PPB)	PH	BC (PPM)	AS (PPB)	SE (PPB)	SO4 (PPM)	CL (PPM)	T-AK (PPM)	BTDS	ATCS
156652	3			<0.5	<0.2	21	69		177.40	
156657	<2			<0.5	0.3	9	36		88.00	
156660	<2			<0.5	0.3	15	57		162.30	
156664	<2			<0.5	0.3	6	47		140.50	
156667	<2			<0.5	<0.2	<5	38		133.40	
156668	2			<0.5	<0.2	5	55		145.20	
156669	<2			<0.5	<0.2	9	70		187.70	
156670	<2			<0.5	<0.2	<5	24		81.20	
156671	<2			<0.5	0.3	6	28		111.60	
156674	<2			<0.5	<0.2	43	164		356.70	
156677	5			<0.5	<0.2	31	99		242.00	
156685	2			0.8	<0.2	9	40		136.20	
156686	37			0.5	0.4	<5	20		34.51	
156687	<2			1.6	0.3	9	56		175.10	
156690	<2			<0.5	<0.2	9	14		87.80	
156692	2			<0.5	<0.2	11	12		87.70	
156695	2			<0.5	0.2	7	49		124.80	
156696	<2			<0.5	0.3	9	19		68.80	
156703	<2			1.5	0.2	35	164		393.90	
156711	<2			<0.5	<0.2	<5	<10		20.60	
156713	2			<0.5	<0.2	6	<10		31.90	
156718	<2			<0.5	<0.2	5	<10		35.20	
156723	<2			<0.5	<0.2	7	<10		25.70	
156725	2			<0.5	0.4	6	<10		21.70	
156732	<2			<0.5	<0.2	6	<10		53.80	
156733	3			<0.5	<0.2	8	<10		27.70	
156736	<2			<0.5	0.2	<5	<10		21.00	
156744	<2			0.5	0.5	<5	<10		84.80	
156746	<2			0.5	0.3	5	26		120.40	
156748	<2			<0.5	0.4	<5	13		90.50	
156753	<2			0.9	0.5	<5	41		150.00	
156755	<2			2.0	0.7	13	55		220.00	
156757	<2			1.0	0.7	<5	45		164.70	
156759	<2			1.0	0.4	<5	29		126.90	
156762	<2			<0.5	0.5	<5	<10		48.90	
156764	<2			<0.5	0.4	<5	<10		42.30	
156766	<2			0.5	0.4	<5	<10		50.50	
156770	<2			<0.5	0.6	<5	<10		13.80	
156780	<2			<0.5	0.5	<5	<10		55.20	
156786	4			<0.5	0.4	<5	<10		24.60	
156788	<2			<0.5	0.3	<5	<10		32.80	
156793	2			<0.5	<0.2	<5	19		61.50	
156795	3			0.5	0.2	<5	16		55.80	
156797	2			<0.5	0.5	<5	<10		49.40	
156799	<2			0.6	0.3	<5	27		113.60	
156811	<2			1.3	0.6	27	46		173.20	
156820	<2			<0.5	0.3	<5	<10		29.10	
156822	<2			<0.5	<0.2	<5	<10		29.40	
156823	2			<0.5	<0.2	<5	<10		25.60	
156826	2			<0.5	<0.2	<5	<10		30.30	
156829	<2			1.3	0.3	29	62		237.30	
156831	<2			<0.5	0.4	<5	18		73.70	
156833	<2			0.6	0.2	<5	<10		34.40	
156838	<2			<0.5	<0.2	<5	18		77.30	
156841	<2			<0.5	<0.2	<5	<10		16.50	

BTDS = Ca + K + Mg + Na + Si + SO_4 + Cl

ATDS = BTDS + total alkalinity

BC = bicarbonate anion

TABLE A-V. Analyses of water samples

RAFT RIVER WATER OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L	TY	REP	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CD (PPB)	CR (PPB)	CU (PPB)	FE (PPB)
156849	40	42.291	-113.543	-3	-01	-	27.93	<2	<10	<4	6	<1	20.6	<2	<4	<2	40
156858	40	42.177	-113.692	-3	-01	-	1.91	2	40	<4	22	1	20.6	2	<4	<2	<10
156861	40	42.161	-113.712	-3	-	-	1.73	2	28	<4	23	1	8.5	<2	<4	<2	<10
158515	40	41.676	-113.778	-3	-	-	3.81	14	15	91	27	<1	20.5	<2	<4	<2	12
158517	40	41.671	-113.785	-3	-	-	6.55	7	14	48	63	<1	41.1	2	<4	<2	12
158521	40	41.956	-113.846	-3	-01	-	5.86	7	<10	48	12	<1	101.7	<2	<4	<2	11
158522	40	41.952	-113.844	-3	-	-	4.20	<2	27	29	16	<1	44.4	<2	<4	<2	12
158536	40	41.780	-113.671	-3	-01	-	<0.20	<2	192	11	5	<1	4.5	3	<4	4	179
158538	40	41.783	-113.684	-3	-01	-	0.79	<2	13	14	7	<1	9.8	<2	<4	2	12
158542	40	41.791	-113.692	-3	-01	-	1.88	3	<10	41	5	<1	43.2	3	6	<2	12
158544	40	41.784	-113.702	-3	-	-	0.97	19	79	53	38	<1	49.0	6	5	<2	15
158545	40	41.775	-113.703	-3	-	-	1.05	<2	22	48	21	<1	58.0	<2	<4	<2	13
158546	40	41.775	-113.719	-3	-01	-	<0.20	<2	10	16	14	<1	9.4	<2	<4	<2	10
158548	40	41.787	-113.722	-3	-01	-	0.53	<2	19	19	24	<1	12.1	<2	<4	<2	<10
158550	40	41.850	-113.509	-3	-01	-	1.76	<2	22	35	24	<1	20.3	<2	<4	4	10
158556	40	41.855	-113.495	-3	-	-	2.41	<2	10	37	19	<1	25.7	<2	<4	2	13
158562	40	41.856	-113.456	-3	-	-	0.31	<2	12	13	8	<1	7.6	4	<4	<2	18
158566	40	41.857	-113.469	-3	-	-	0.77	2	13	67	20	<1	24.5	<2	<4	<2	89
158569	40	41.855	-113.394	-3	-	-	0.65	<2	<10	31	17	<1	19.3	<2	<4	2	14
158571	40	41.855	-113.417	-3	-01	-	43.14	7	11	112	40	<1	43.6	<2	<4	<2	13
158572	40	41.862	-113.425	-3	-	-	1.90	5	<10	33	14	<1	16.6	2	4	<2	12
158575	40	41.862	-113.427	-3	-	-	0.63	<2	25	26	29	1	21.3	<2	<4	<2	501
158578	40	41.847	-113.645	-3	-	-	1.07	2	<10	50	26	<1	65.4	<2	<4	<2	11
158584	40	41.854	-113.645	-3	-01	-	1.95	<2	13	52	13	<1	80.5	<2	<4	<2	12
158585	40	41.861	-113.621	-3	-	-	0.92	<2	19	33	31	<1	37.5	<2	<4	<2	21
158593	40	41.742	-113.722	-3	-	-	13.51	3	20	32	32	<1	41.7	4	<4	<2	15
158597	40	41.739	-113.734	-3	-01	-	6.14	8	15	22	17	<1	19.3	<2	<4	<2	12
158603	40	41.728	-113.766	-3	-	-	4.22	5	<10	43	14	<1	23.2	4	5	<2	29
158605	40	41.728	-113.766	-3	-	-	8.04	<2	23	34	16	<1	20.8	<2	<4	2	27
158607	40	41.744	-113.773	-3	-	-	7.66	<2	12	36	20	<1	26.3	<2	<4	<2	14
158609	40	41.743	-113.773	-3	-	-	10.91	<2	<10	51	26	<1	51.5	<2	<4	<2	12
158613	40	41.741	-113.741	-3	-	-	5.74	<2	10	25	12	<1	22.1	<2	<4	<2	13
158616	40	41.980	-113.834	-3	-01	-	<0.20	<2	16	12	16	<1	9.6	<2	<4	<2	15
158620	40	41.977	-113.825	-3	-	-	<0.20	<2	<10	23	15	<1	15.9	<2	<4	<2	14
158623	40	41.965	-113.817	-3	-	-	1.12	12	22	24	15	<1	15.3	<2	<4	3	12
158627	40	41.950	-113.804	-3	-	-	1.88	32	11	18	18	<1	46.8	<2	<4	<2	10
158630	40	41.948	-113.791	-3	-	-	1.85	<2	<10	17	11	<1	38.2	<2	<4	<2	13
158631	40	41.767	-113.768	-3	-01	-	11.59	<2	10	41	38	<1	37.2	<2	<4	<2	13
158634	40	41.772	-113.772	-3	-	-	1.90	<2	<10	37	24	<1	19.1	<2	<4	<2	19
158637	40	41.778	-113.786	-3	-	-	2.35	3	<10	32	17	<1	15.0	<2	<4	<2	15
158640	40	41.778	-113.758	-3	-01	-	10.81	5	17	42	22	<1	26.5	<2	<4	<2	<10
158642	40	41.774	-113.751	-3	-	-	0.98	<2	16	43	15	<1	16.4	2	<4	<2	24
158647	40	41.762	-113.755	-3	-	-	6.63	<2	26	37	18	<1	20.5	<2	<4	<2	11
158657	40	41.931	-113.776	-3	-01	-	0.58	2	148	45	57	<1	27.1	<2	4	3	119
158660	40	41.746	-113.700	-3	-	-	0.27	<2	<10	21	18	<1	45.7	<2	<4	<2	13
158662	40	41.742	-113.705	-3	-	-	0.62	<2	<10	17	28	<1	18.6	<2	<4	<2	20
158664	40	41.741	-113.705	-3	-	-	3.72	<2	<10	30	19	<1	19.2	<2	<4	<2	16
158666	40	41.749	-113.683	-3	-	-	1.98	<2	20	33	25	<1	44.2	<2	<4	3	16
158669	40	41.901	-113.621	-3	-	-	2.09	<2	<10	68	57	<1	44.1	<2	<4	<2	15
158678	40	41.712	-113.714	-3	-	-	1.30	<2	<10	19	5	<1	11.5	<2	<4	<2	10
158680	40	41.712	-113.714	-3	-01	-	8.98	<2	<10	22	6	<1	14.5	<2	<4	<2	12
158682	40	41.880	-113.451	-3	-	-	0.85	6	16	14	12	<1	9.5	3	<4	<2	10
158695	40	41.688	-113.791	-3	-	-	12.63	5	23	40	21	<1	27.4	<2	<4	2	13
158698	40	41.967	-113.659	-3	-	-	4.53	<2	<10	81	60	<1	77.5	2	<4	<2	16
158707	40	41.958	-113.541	-3	-	-Y	5.57	3	<10	130	27	<1	48.0	<2	<4	<2	12

TABLE A-V. Analyses of water samples

RAFT RIVER WATER — SECTION 2 OF 3

OR SAMPLE NUMBER	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)	Y (PPB)	ZN (PPB)
156849	2.6	3	3.0	<2	<4	9.6	<4	<40	<1	5.1	69	<2	<4	<1	<4
156858	2.6	<2	1.5	<2	<4	3.1	<4	<40	1	5.0	48	<2	<4	<1	<4
156861	1.8	2	2.0	2	<4	4.1	4	<40	1	6.0	53	<2	<4	<1	<4
158515	2.3	19	3.8	2	<4	13.2	10	<40	<1	12.1	112	<2	4	<1	17
158517	1.6	11	14.3	<2	5	14.7	<4	<40	<1	7.8	120	<2	<4	<1	18
158521	2.3	13	7.5	<2	7	19.3	<4	<40	<1	4.8	371	<2	<4	1	14
158522	1.5	3	9.3	2	<4	5.7	<4	<40	<1	6.5	117	<2	<4	<1	11
158536	2.4	<2	1.0	3	<4	4.4	8	<40	<1	3.3	24	6	<4	<1	18
158538	0.6	<2	1.9	<2	5	4.3	7	<40	<1	4.0	43	<2	<4	<1	23
158542	1.6	3	7.3	<2	21	24.8	11	<40	<1	7.9	131	<2	18	1	6
158544	2.7	5	6.8	2	<4	17.8	<4	<40	<1	7.6	144	<2	7	1	12
158545	1.5	5	5.6	<2	<4	18.3	<4	<40	<1	6.5	158	<2	<4	<1	8
158546	1.0	<2	2.2	<2	<4	7.5	<4	<40	<1	7.1	59	<2	<4	<1	5
158548	1.1	2	2.2	<2	<4	7.2	<4	<40	<1	8.7	74	<2	<4	<1	38
158550	1.7	4	4.4	2	<4	14.0	23	<40	<1	6.3	119	<2	<4	<1	37
158556	1.8	4	4.8	3	<4	17.1	<4	52	<1	2.0	115	<2	<4	<1	4
158562	0.6	2	1.9	<2	<4	6.6	<4	<40	<1	3.7	43	<2	<4	<1	<4
158566	2.7	8	5.8	75	<4	23.5	<4	<40	<1	1.4	131	<2	8	<1	4
158569	1.6	4	4.2	<2	<4	15.7	7	<40	<1	5.1	100	<2	<4	<1	<4
158571	2.0	7	7.9	3	<4	27.7	16	<40	<1	7.0	247	<2	<4	<1	20
158572	1.5	2	3.1	2	<4	7.6	21	<40	<1	4.1	94	<2	<4	1	21
158575	2.6	3	4.4	132	<4	15.6	<4	<40	<1	4.6	110	<2	12	1	<4
158578	2.4	7	7.2	<2	<4	27.0	4	<40	<1	10.2	179	<2	9	1	5
158584	0.8	7	8.1	2	13	32.8	<4	<40	<1	7.6	214	<2	<4	<1	<4
158585	2.4	5	4.8	<2	<4	15.4	4	<40	<1	12.4	129	<2	<4	<1	5
158593	2.6	5	9.2	<2	<4	25.7	<4	<40	<1	10.7	193	<2	9	1	<4
158597	2.3	3	3.6	<2	8	9.7	<4	<40	<1	9.0	86	<2	<4	<1	16
158603	3.6	6	5.6	<2	<4	18.8	<4	<40	<1	12.3	103	<2	18	1	<4
158605	3.2	8	5.4	<2	<4	16.0	<4	<40	<1	11.9	97	<2	10	<1	<4
158607	4.3	5	6.4	<2	<4	18.6	12	<40	<1	12.2	115	<2	<4	1	<4
158609	4.3	8	9.6	<2	10	23.6	<4	<40	<1	12.8	187	<2	<4	<1	5
158613	3.7	4	3.7	<2	<4	14.9	<4	<40	<1	10.6	86	<2	<4	<1	<4
158616	1.9	2	2.7	<2	17	6.2	4	<40	<1	11.9	56	<2	<4	<1	<4
158620	2.1	2	3.6	<2	17	7.6	<4	<40	<1	11.6	70	<2	<4	<1	<4
158623	2.3	2	2.0	<2	6	6.7	16	45	<1	10.8	69	<2	<4	<1	14
158627	1.2	<2	2.9	2	6	3.2	4	54	<1	7.3	52	<2	5	1	14
158630	1.3	3	4.1	<2	<4	8.4	<4	<40	<1	12.9	109	<2	<4	<1	5
158631	4.5	10	10.7	<2	<4	21.2	6	<40	<1	15.0	194	<2	<4	<1	5
158634	2.2	6	4.7	<2	<4	16.5	4	<40	<1	13.5	108	<2	5	<1	<4
158637	2.3	5	3.9	<2	5	12.5	<4	<40	<1	11.0	82	<2	8	<1	<4
158640	1.5	8	6.2	<2	16	26.6	<4	<40	<1	16.0	128	<2	<4	<1	15
158642	2.4	4	3.8	<2	<4	20.9	<4	<40	<1	13.9	99	<2	20	<1	<4
158647	2.4	5	4.7	<2	11	19.8	<4	<40	<1	11.9	102	<2	<4	<1	9
158657	13.5	14	5.7	4	<4	16.4	<4	<40	<1	21.2	171	5	29	1	8
158660	3.0	2	4.1	<2	7	10.3	<4	45	<1	5.7	150	<2	<4	<1	<4
158662	2.6	5	4.4	<2	<4	9.6	<4	<40	<1	14.1	135	<2	<4	<1	<4
158664	2.4	3	5.0	<2	<4	15.7	<4	<40	<1	10.0	58	<2	<4	<1	<4
158666	2.9	3	7.2	<2	10	17.2	<4	<40	<1	8.3	138	<2	4	<1	5
158669	6.9	14	11.4	<2	<4	30.4	5	44	<1	15.7	274	<2	14	<1	6
158678	1.7	2	2.9	<2	<4	10.5	5	<40	<1	9.1	85	<2	<4	<1	8
158680	1.9	3	2.9	<2	<4	10.9	<4	<40	<1	9.4	57	<2	<4	1	10
158682	1.5	2	2.3	<2	<4	6.6	5	<40	<1	4.5	52	<2	4	<1	8
158695	3.7	14	7.3	<2	<4	21.6	<4	<40	<1	9.0	114	<2	<4	<1	10
158698	8.7	18	14.9	<2	<4	35.3	<4	<40	<1	21.9	338	<2	<4	<1	26
158707	3.3	21	17.2	7	<4	47.0	<4	<40	<1	14.7	307	<2	<4	<1	180

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

DR SAMPLE NUMBER	ZR (PPB)	PH	BC (PPM)	AS (PPB)	SE (PPB)	SO4 (PPM)	CL (PPM)	T-AK (PPM)	BTDS	ATDS
156849	<2			0.6	0.9	7	<10		53.90	
156858	<2			0.5	0.4	8	<10		46.80	
156961	<2			<0.5	0.3	<5	<10		30.90	
158515	<2			<0.5	<0.2	<5	30		85.40	
158517	3			<0.5	<0.2	15	42		137.50	
158521	3			0.8	<0.2	75	37		248.60	
158522	<2			1.0	0.3	18	15		101.40	
158536	<2			<0.5	0.2	5	<10		27.00	
158538	2			<0.5	<0.2	7	14		42.60	
158542	3			<0.5	0.3	13	51		149.80	
158544	9			<0.5	<0.2	12	49		145.90	
158545	<2			<0.5	<0.2	12	44		146.90	
158546	<2			<0.5	<0.2	<5	11		41.70	
158548	<2			<0.5	<0.2	7	17		56.30	
158550	<2			0.7	<0.2	11	31		89.70	
158556	<2			1.8	0.5	5	24		81.40	
158562	<2			<0.5	<0.2	<5	10		33.90	
158566	<2			<0.5	<0.2	5	33		97.20	
158569	<2			<0.5	0.2	5	26		77.90	
158571	<2			<0.5	<0.2	12	88		189.20	
158572	7			<0.5	<0.2	7	18		58.90	
158575	2			0.6	<0.2	<5	20		72.00	
158578	7			<0.5	0.3	6	60		179.20	
158584	<2			<0.5	0.3	8	74		212.80	
158585	<2			<0.5	<0.2	<5	28		104.00	
158593	4			<0.5	<0.2	7	81		178.90	
158597	<2			<0.5	<0.2	<5	32		79.40	
158603	6			<0.5	0.2	5	28		97.50	
158605	<2			<0.5	<0.2	7	41		106.30	
158607	3			<0.5	0.2	5	36		109.80	
158609	<2			<0.5	<0.2	6	41		149.80	
158613	<2			<0.5	0.2	<5	29		87.50	
158616	<2			<0.5	<0.2	<5	<10		40.80	
158620	<2			<0.5	<0.2	5	<10		51.80	
158623	<2			<0.5	<0.2	<5	13		53.60	
158627	3			<0.5	<0.2	<5	<10		69.90	
158630	<2			<0.5	<0.2	<5	10		78.40	
158631	<2			<0.5	<0.2	<5	61		153.10	
158634	<2			<0.5	<0.2	<5	23		82.50	
158637	3			<0.5	<0.2	5	16		66.70	
158640	<2			<0.5	<0.2	7	42		126.80	
158642	<2			<0.5	<0.2	5	26		89.40	
158647	<2			<0.5	<0.2	7	31		98.30	
158657	4			<0.5	0.6	<5	40		127.40	
158660	<2			<0.5	0.5	8	24		105.80	
158662	<2			<0.5	<0.2	<5	37		89.80	
158664	<2			<0.5	<0.2	5	37		95.30	
158666	<2			<0.5	0.3	10	45		135.80	
158669	<2			0.5	0.2	<5	65		177.00	
158678	2			<0.5	<0.2	7	15		58.70	
158680	7			<0.5	<0.2	7	15		63.00	
158682	<2			<0.5	<0.2	7	<10		37.80	
158695	<2			<0.5	<0.2	7	37		114.00	
158698	3			1.6	<0.2	20	69		248.30	
158707	<2			1.0	<0.2	15	40		186.20	

BTDS = Ca + K + Mg + Na + Si + SO_4 + Cl

ATDS = BTDS + total alkalinity

BC = bicarbonate anion

TABLE A-V. Analyses of water samples

RAFT RIVER WATER

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L	TY	REP	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CO (PPB)	CR (PPB)	CU (PPB)	FE (PPB)
158708	40-	41.949	-113.567	-3-		-Y	4.00	<2	29	113	78	<1	105.3	<2	<4	<2	14
158712	40-	41.817	-113.618	-3-		-	4.13	2	25	64	86	5	81.9	9	8	5	19
158717	40-	41.812	-113.587	-3-		-	5.36	<2	12	55	31	<1	73.5	<2	<4	<2	11
158719	40-	41.821	-113.644	-3-		-	1.60	6	<10	44	35	<1	74.5	<2	<4	<2	12
158733	40-	41.896	-113.200	-3-		-	2.86	10	11	56	34	<1	64.9	7	<4	<2	<10
158736	40-	41.938	-113.267	-3-		-	3.12	<2	<10	67	48	<1	37.8	<2	<4	<2	13
158740	40-	41.937	-113.281	-3-		-	2.03	<2	<10	27	18	<1	24.5	5	<4	<2	<10

TABLE A-V. Analyses of water samples

7-a

RAFT RIVER WATER

SECTION 2 OF 3

OR SAMPLE NUMBER	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)	Y (PPB)	ZN (PPB)
158708	6.7	26	24.2	4	<4	49.7	<4	<40	<1	20.0	545	<2	<4	<1	449
158712	4.3	15	12.8	7	<4	34.1	6	50	3	12.6	307	4	12	6	17
158717	3.1	9	10.7	<2	7	34.8	<4	<40	<1	9.3	268	<2	<4	<1	13
158719	2.4	7	12.8	<2	<4	28.1	4	<40	<1	9.6	252	<2	<4	<1	23
158733	2.5	5	14.4	<2	<4	37.9	6	<40	<1	7.0	224	<2	<4	<1	18
158736	4.0	7	9.2	2	<4	27.6	<4	42	<1	7.3	202	<2	<4	<1	16
158740	2.0	3	6.6	<2	<4	19.7	<4	<40	<1	6.4	101	<2	<4	<1	9

TABLE A-V. Analyses of water samples

7-b

RAFT RIVER WATER

OR SAMPLE NUMBER	ZR (PPB)	PH	BC (PPM)	AS (PPB)	SE (PPB)	SO4 (PPM)	CL (PPM)	T-AK (PPM)	BTDS	ATDS
158708	2			2.2	<0.2	32	195		433.90	
158712	8			0.7	<0.2	13	77		237.70	
158717	<2			<0.5	<0.2	19	73		221.40	
158719	<2			<0.5	<0.2	<5	72		202.90	
158733	3			2.8	1.4	20	67		214.70	
158736	<2			<0.5	<0.2	22	72		180.90	
158740	<2			<0.5	<0.2	12	35		107.20	

BTDS = Ca + K + Mg + Na + Si + SO_4 + Cl

ATDS = BTDS + total alkalinity

BC = bicarbonate anion

TABLE A-V. Analyses of water samples

SAMPLE NUMBER	GEO. CODE
154478	PEA
154481	PEA
154483	PEA
154485	PEA
154492	PEE
154516	PEE
154520	QO
154522	PEA
154527	PESS
154530	PESS
154538	PEA
154541	PEA
154544	PEA
154546	TSL
154559	PEUN
154563	PEE
154564	PEE
154576	PEA
154579	PEA
154585	PEA
154588	PEA
154590	QAS
154595	PEE
154597	QAS
154599	PEA
154600	PEA
154602	PEA
154604	QAS
154610	PEE
154616	PEE
154617	PEE
154621	QO
154623	QO
154625	PEA
154627	PESS
154681	ENS
154682	ENS
154683	QF
154684	MM
154685	MM
154686	MM
154687	MM
154688	WG
154689	WG
154690	PEE
154691	PEA
154693	PEA
154695	PEOS
154698	PETR
154700	PETR
154702	PEMI
154704	OP
154706	PEE
154708	QO
154710	QO
154712	PEA
154713	PEE
154715	PEMI
154717	PEE
154737	PEE
154741	PEMI
154746	PEOS
154749	PEOS
154656	PEE
154766	QO
154768	PEE
154771	PEMI
154772	PEMI
154774	PEOS
154776	PEOS
154778	PEA
154782	PEUN
154783	PEE
154784	PEE
154786	PEA
154788	PEA
154790	WG
154791	ZHS
154793	PRO
154797	ZHS
154800	TVG
154803	QF
154807	QF
154809	QF
154810	PEE
154811	QF
154813	QF
154815	XE
154817	OP
154819	OP
154822	ECB
154824	WG
154826	WG

SAMPLE NUMBER	GEO. CODE
154831	PEE
154833	PEE
154835	PEE
154841	XE
154847	XE
154848	WG
154854	QF
154855	PEA
154858	PEA
154860	WG
154863	PEE
154865	PEE
154867	WG
154869	XE
154881	PEA
154891	PEE
154893	PEE
154902	PEE
154908	TSL
154913	PEA
154915	PEA
154917	PEA
154918	PEA
154921	PEA
154926	PEE
154927	XE
156444	QF
156452	TVG
156454	QF
156455	QF
156461	WG
156463	WG
156467	EMP
156474	WG
156475	XE
156476	XE
156477	WG
156478	XE
156479	XE
156480	PRO
156484	DC
156486	DC
156489	XE
156490	XE
156491	WG
156492	XE
156493	WG
156495	WG
156496	WG
156497	WG
156498	PEE
156499	PEE
156500	ENS
156501	PEE
156502	PEE
156503	WG
156505	PEE
156506	QF
156507	QF
156508	WG
156509	WG
156511	MM
156512	ZHS
156513	CD
156514	ZHS
156515	OP
156516	CD
156522	PEE
156530	WG
156531	WG
156533	ENS
156534	PEE
156536	WG
156542	ECB
156543	EMP
156544	ENS
156545	PEE
156547	PEE
156548	WG
156550	PEE
156551	WG
156553	WG
156555	QU
156558	QU
156559	EMP
156561	PO
156563	XE
156565	XE
156566	XUN
156567	XUN
156570	QU
156571	PO
156572	ENS

SAMPLE NUMBER	GEO. CODE
156574	PEE
156577	PEE
156582	PEA
156595	PEUN
156596	PEUN
156597	PEUN
156599	PEUN
156600	PEE
156604	QO
156607	ECB
156608	ECB
156610	PEY
156611	OP
156612	OP
156615	PESS
156617	PEY
156618	ECB
156619	EMP
156620	PESS
156621	PEUN
156623	PEY
156625	PEE
156626	PEE
156627	PEUN
156629	ECB
156631	PEUN
156632	PEY
156633	ECB
156635	PEE
156638	PEE
156639	OP
156641	OP
156642	OP
156648	PEUN
156649	PEUN
156652	PEUN
156657	PESS
156660	ECB
156664	EMP
156667	ECB
156668	PESS
156669	QO
156670	PEY
156671	PESS
156674	PEUN
156677	PEUN
156685	TSL
156686	TSL
156687	TSL
156690	ECB
156692	QAS
156695	ECB
156696	PEA
156703	PEA
156711	WG
156713	WG
156718	WG
156723	WG
156725	WG
156732	XUN
156733	XE
156736	WG
156744	GN
156746	MM
156748	QF
156753	PEE
156755	MM
156757	MM
156759	MM
156762	PEE
156764	MM
156766	ECB
156770	PEE
156780	XUN
156786	PEA
156788	XE
156793	PEE
156795	PEA
156797	WG
156799	WG
156811	PEA
156820	XE
156822	XE
156823	XE
156826	XUN
156829	TSL
156831	TSL
156833	ECB
156838	ECB
156841	WG
156849	WG
156858	WG
156861	PEE

SAMPLE NUMBER	GEO. CODE
158515	PEA
158517	TSL
158521	QAS
158522	ECB
158536	PEUN
158538	PESS
158542	PESS
158544	PESS
158545	ECB
158546	PEE
158548	PEE
158550	PEE
158556	PEE
158562	QO
158566	QO
158569	PEE
158571	PEE
158572	PEE
158575	QO
158578	PEE
158584	PEY
158593	PRO
158597	PEA
158603	PEA
159605	PEA
158607	PEA
158609	PEA
158611	QAG
158613	ECB
158616	ECB
158620	ECB
158623	PEA
158627	ECB
158628	PEA
158630	ECB
158631	ECB
158634	PEA
158637	PEE
158640	PEE
158642	PEA
158647	PEA
158657	PEA
158660	PEA
158662	PEA
158664	PEA
158666	PEE
158669	PEE
158678	PEA
158680	PEA
158682	PEA
158695	PEA
158698	PEUN
158707	QAL
158708	QAL
158712	QAL
158717	PEA
158719	QAL
158733	QAL
158736	QAL
158740	PEOS

TABLE A-VI. Geologic unit code Index for water samples

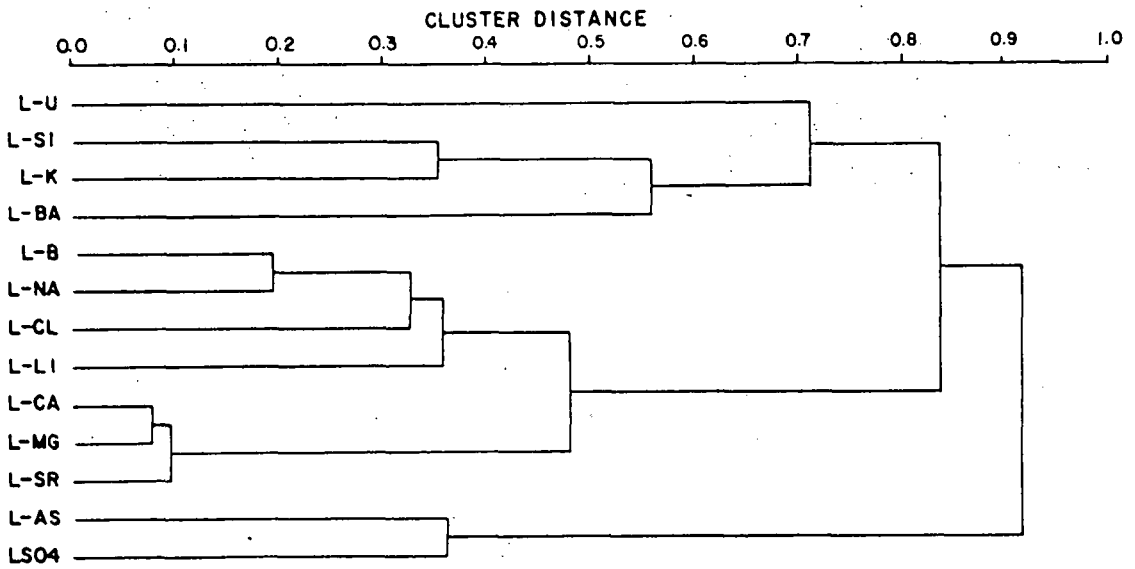
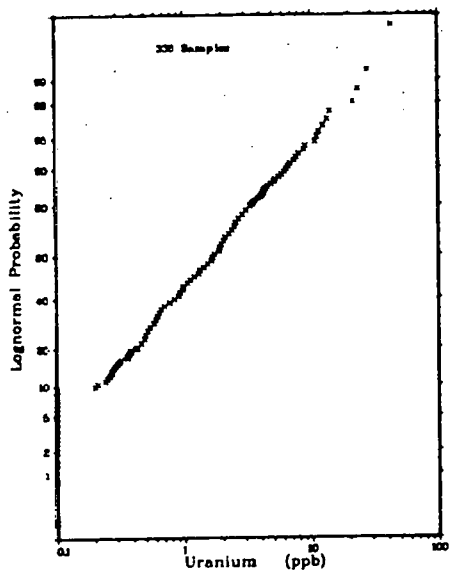


Figure A-1. Cluster analysis (dendrogram) of correlation matrix for water samples



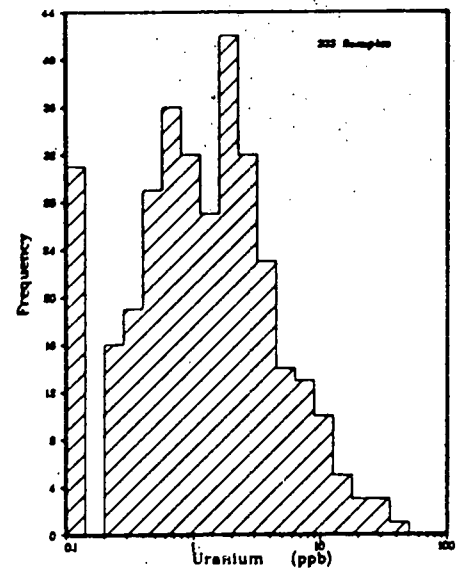


Figure A-2. Logprobability and logfrequency plots of uranium concentrations in water samples

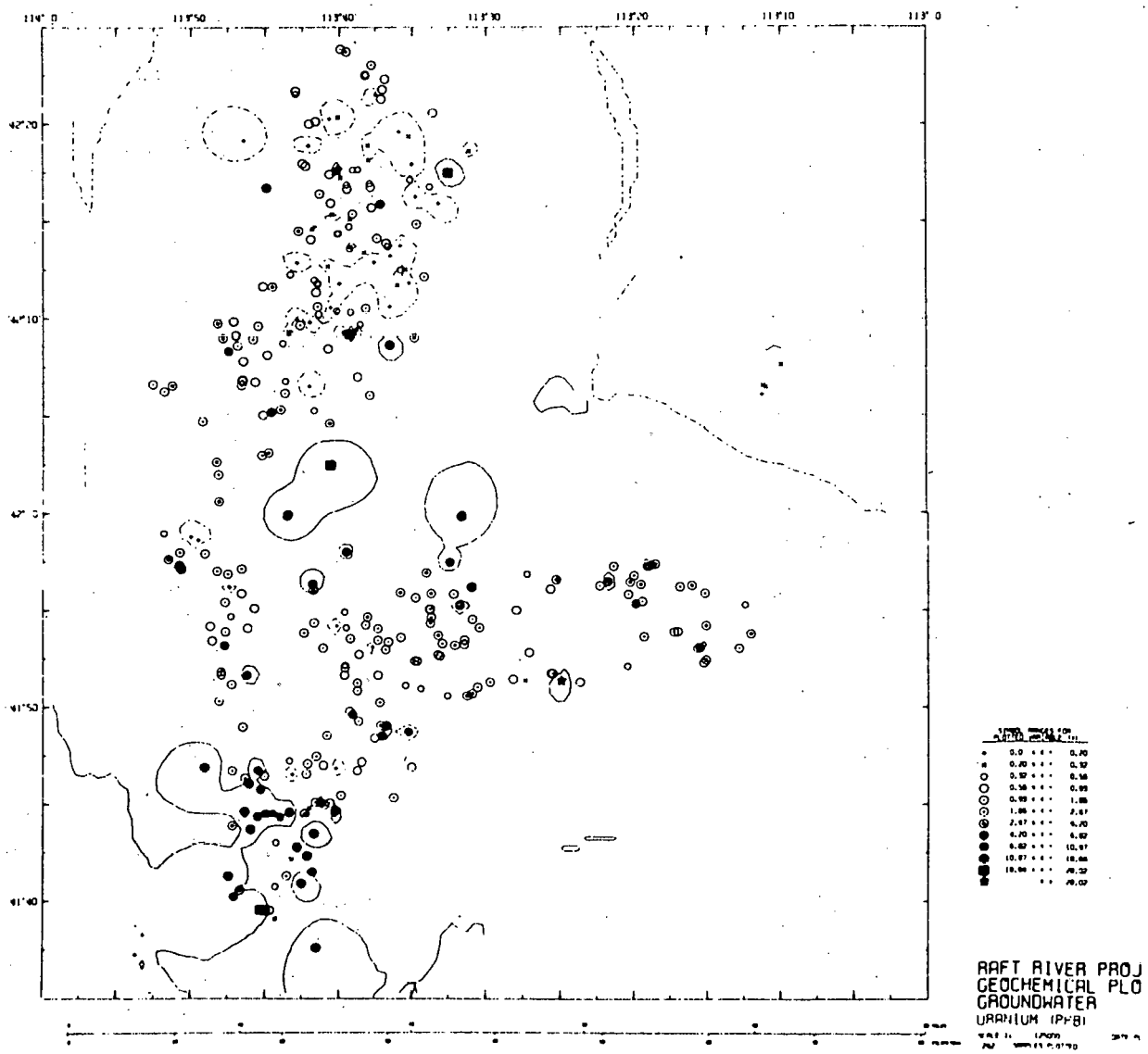


Figure A-3. Areal distribution of uranium concentrations in water samples

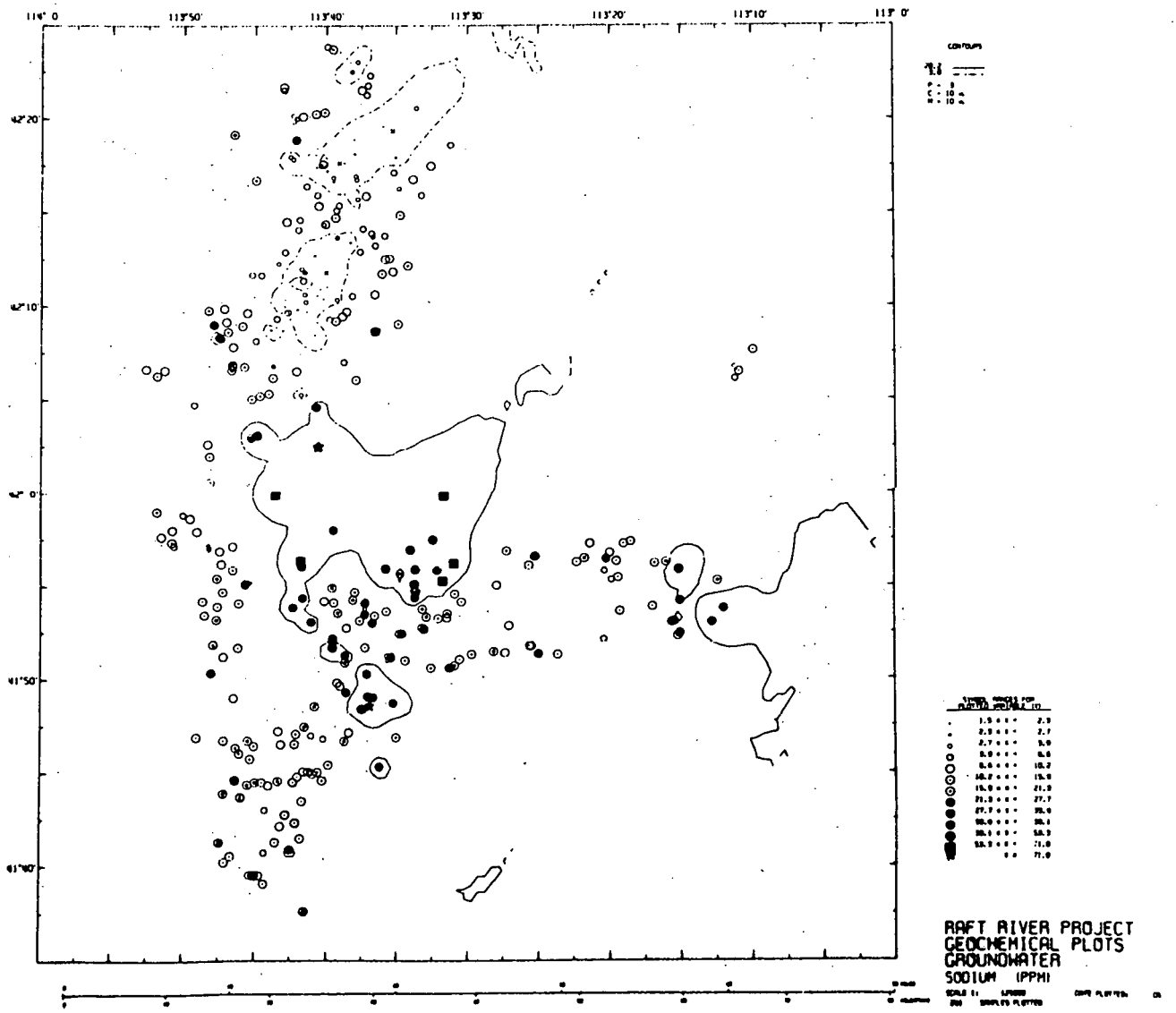


Figure A-4. Areal distribution of sodium concentrations in water samples

RAFT RIVER SEDIMENT

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	ROBUST MEAN	ROBUST S. D.
U	617			0.67	102.80	6.17	3.31	2.74	10.204	1.654	1.40	0.74	1.33	0.75
UANT	614			0.90	101.80	7.61	4.70	4.09	10.152	1.335	1.71	0.66	1.65	0.63
U/TU	614			0.13	1.76	0.76	0.77	0.77	0.183	0.242	-0.31	0.28	-0.29	0.24
AG	4	612	<2	<2	12	7	<2	<2	5.3	0.7	1.76	0.88		
AL	615	1	<0.05	<0.05	17.00	6.03	6.00	6.02	1.246	0.207	1.77	0.23	1.79	0.20
B	452	164	<10	<10	52	19	16	15	6.7	0.3	2.93	0.33	2.74	0.48
BA	615	1	<2	<2	3020	720	715	765	208.7	0.3	6.54	0.30	6.55	0.24
BE	612	4	<1	<1	6	2	2	1	0.6	0.3	0.75	0.28		
CA	615	1	<0.05	<0.05	25.58	1.88	1.27	1.07	2.424	1.288	0.33	0.68	0.30	0.66
CD	573	43	<4	<4	23	7	7	6	3.0	0.4	2.01	0.35	1.96	0.39
CR	614	2	<1	<1	229	49	47	45	20.9	0.4	3.83	0.41	3.83	0.41
CU	613	3	<2	<2	92	21	20	19	10.5	0.5	2.94	0.48	2.94	0.50
FE	614	2	<0.05	<0.05	6.50	2.73	2.62	2.70	0.824	0.302	0.96	0.31	0.96	0.31
LI	616			2	67	32	33	33	9.2	0.3	3.43	0.34	3.46	0.28
MG	615	1	<0.05	<0.05	4.60	0.85	0.74	0.67	0.455	0.536	-0.26	0.42	-0.27	0.41
MN	614	2	<4	<4	4075	626	594	642	290.0	0.5	6.36	0.40	6.37	0.38
MO	3	613	<4	<4	10	7	<4	<4	2.1	0.3	2.01	0.26		
NA	615	1	<0.05	<0.05	14.30	1.15	0.95	0.67	0.811	0.707	-0.02	0.55	-0.01	0.53
NB	590	26	<4	<4	131	12	9	6	13.5	1.0	2.33	0.59	2.24	0.64
NI	613	3	<2	<2	79	21	19	17	10.5	0.5	2.97	0.46	2.97	0.50
P	615	1	<5	<5	5245	981	889	763	459.8	0.5	6.80	0.43	6.80	0.41
SC	614	2	<1	<1	21	7	8	7	2.6	0.3	2.01	0.34	2.02	0.32
TH	611	5	<2	<2	114	15	13	11	8.9	0.6	2.57	0.53	2.57	0.56
TI	614	2	<10	<10	14364	3187	2855	2887	1446.2	0.5	7.99	0.39	7.98	0.38
V	614	2	<2	<2	175	62	60	57	21.7	0.3	4.08	0.35	4.09	0.35
Y	614	2	<1	<1	76	22	21	19	8.0	0.4	3.05	0.33	3.05	0.31
ZN	615	1	<2	<2	300	79	77	77	27.1	0.3	4.31	0.35	4.33	0.32
ZR	614	2	<2	<2	188	54	54	41	25.3	0.5	3.87	0.55	3.89	0.52
K	616			0.39	3.40	1.65	1.63	1.69	0.366	0.221	0.48	0.24	0.49	0.23
SR	615	1	<1	<1	870	176	165	161	61.8	0.4	5.12	0.31	5.13	0.27
CE	612	4	<10	<10	330	81	75	75	35.7	0.4	4.33	0.38	4.32	0.35
TGAM	37			5	7800	3912	3600	7328	2846.4	0.7	7.12	2.55	7.23	2.54
TOT	2			9184	9646	9415	9184	11011	326.7	0.0	9.15	0.04		
EK	3			0.1	6.5	2.3	0.2	833.5	3.61	1.55	-0.45	2.13		
CPK	2			33	258	145	33	1703	159.1	1.1	4.52	1.45		
EU	3			1.4	9.0	4.4	2.0	834.8	4.06	0.93	1.18	0.94		
CPU	2			20	54	37	20	1687	24.0	0.6	3.49	0.70		
ETH	3			6.8	30.7	16.9	10.0	840.5	12.36	0.73	2.64	0.76		
CPTH	2			17	39	28	17	1684	15.6	0.6	3.25	0.59		

Table B-I. Summary statistics for sediment samples

	L-U	LUNT	L-B	L-ZR	L-BA	L-K	L-CA	L-MG	L-SC	L-V	L-CO	L-CR	L-NI	L-CU	L-LI	L-ZN	L-P	L-Y	L-MN	LTGM	L-TI	L-TH	L-CE	L-AL	L-NA	L-DE	L-NB	L-SR
L-U	1.00 (617)	0.93*** 0.81*** (617)	-0.14*** -0.13*** (452)	-0.09** -0.09** (614)	0.00 0.04 (615)	0.07* 0.11*** (616)	-0.15*** -0.16*** (615)	-0.10** -0.12*** (615)	0.18*** 0.19*** (614)	0.09** 0.08** (614)	0.08* 0.10** (573)	0.04 0.04 (614)	0.15*** 0.13*** (613)	0.27*** 0.24*** (613)	0.17*** 0.15*** (616)	0.13*** 0.12*** (615)	-0.00 0.02 (615)	0.27*** 0.34*** (614)	0.07 0.07* (614)	0.47*** 0.38** (37)	0.05 0.10** (614)	0.33*** 0.38*** (611)	0.12*** 0.15*** (612)	0.21*** 0.20*** (615)	0.23*** 0.27*** (615)	0.10*** 0.19*** (612)	-0.03 -0.02 (590)	-0.11*** -0.23*** (615)
LUNT		1.00 (614)	-0.22*** -0.27*** (451)	-0.17*** -0.25*** (613)	0.11*** 0.14*** (613)	0.13*** 0.15*** (614)	-0.15*** -0.14*** (613)	-0.18*** -0.23*** (613)	0.14*** 0.14*** (613)	0.02 -0.03 (613)	0.04 0.04 (573)	0.00 -0.00 (613)	0.12*** 0.09** (612)	0.14*** 0.06 (612)	0.08* -0.07* (613)	0.11*** 0.03 (614)	0.08 -0.07* (615)	0.02 0.01 (614)	0.14*** 0.35*** (613)	0.06 0.06 (613)	0.57*** 0.47*** (37)	0.11*** 0.18*** (613)	0.51*** 0.51*** (610)	0.48*** 0.51*** (612)	0.31*** 0.31*** (614)	0.19*** 0.31*** (611)	0.05 0.10** (589)	0.15*** -0.03 (614)
L-B			1.00 (452)	0.53*** 0.54*** (451)	0.07 0.06 (452)	0.14*** 0.17*** (452)	0.07 0.03 (452)	0.06* 0.11**	0.05 -0.03	0.05 0.09*	0.02 0.06	0.08 0.09**	0.04 0.03	0.22*** 0.26***	0.23*** 0.31***	0.35*** 0.31***	0.19*** 0.16***	0.04 0.31***	0.13*** 0.23***	-0.23 -0.26	0.68*** 0.64***	0.70*** 0.57***	0.08 0.07	0.45*** 0.31***	0.46*** 0.39***	0.35*** 0.31***	0.34*** 0.31***	0.07* 0.20***	0.01 0.20***
L-ZR				1.00 (614)	0.20*** 0.23***	0.15*** 0.15***	-0.08** -0.22***	0.04 -0.03	0.07* -0.06	0.16*** 0.09**	0.01 -0.00	0.13*** 0.03	0.18*** 0.07*	0.23*** 0.23***	0.47*** 0.36***	0.35*** 0.36***	0.26*** 0.20***	0.07* 0.20***	0.26*** 0.23***	0.03 -0.01	0.70*** 0.64***	0.71*** 0.57***	0.07 0.07	0.26*** 0.19***	0.26*** 0.20***	0.39*** 0.31***	0.39*** 0.31***	0.26*** 0.20***	-0.07* -0.05
L-BA					1.00 (615)	0.56*** 0.56*** (615)	-0.22*** -0.17***	0.22*** 0.27***	0.08* 0.08*	0.09** 0.09**	-0.12*** -0.19***	0.10*** -0.24***	0.08** -0.19***	-0.04 -0.12***	0.39*** 0.15***	0.35*** 0.15***	0.07 0.07	0.29*** 0.17***	0.32*** 0.19***	0.71*** 0.71***	0.25*** 0.07	0.74*** 0.72***	0.45*** 0.47***	0.44*** 0.45***	0.44*** 0.45***	0.23*** 0.23***	0.20*** 0.20***	0.20*** 0.20***
L-K						1.00 (616)	-0.43*** -0.34***	0.62*** 0.58***	0.21*** 0.12***	0.08* 0.02	0.05 0.07*	0.04 0.00	0.05 0.04	0.05 0.01	0.31*** 0.19***	0.42*** 0.40***	0.03 0.01	0.26*** 0.14***	0.26*** 0.14***	0.71*** 0.71***	0.09** 0.09**	0.71*** 0.67***	0.47*** 0.47***	0.48*** 0.45***	0.48*** 0.44***	0.27*** 0.25***	0.13*** 0.05	0.28*** 0.20***
L-CA							1.00 (615)	-0.06 0.01	-0.06 0.01	-0.01 0.01	-0.10** -0.10**	0.05 0.05	0.02 0.02	-0.02 -0.09**	-0.09** -0.09**	-0.07* -0.07*	-0.07* -0.07*	0.07* 0.07*	0.07* 0.07*	0.37*** 0.37***	0.07 0.07	0.37*** 0.37***	0.37*** 0.37***	0.35*** 0.35***	0.35*** 0.35***	0.42*** 0.42***	0.42*** 0.42***
L-MG								1.00 (615)	0.43*** 0.54***	0.52*** 0.58***	0.41*** 0.45***	0.50*** 0.57***	0.54*** 0.59***	0.39*** 0.41***	0.25*** 0.34***	0.26*** 0.33***	0.26*** 0.33***	0.02 0.07*	0.48*** 0.45***	0.25*** 0.25***	0.25*** 0.25***	0.25*** 0.25***	0.25*** 0.25***	0.25*** 0.25***	0.25*** 0.25***	0.25*** 0.25***	0.25*** 0.25***
L-SC									1.00 (614)	0.87*** 0.87***	0.77*** 0.75***	0.65*** 0.72***	0.76*** 0.77***	0.60*** 0.55***	0.36*** 0.33***	0.37*** 0.36***	0.37*** 0.36***	0.13*** 0.07*	0.45*** 0.45***	0.53*** 0.53***	0.53*** 0.53***	0.53*** 0.53***	0.53*** 0.53***	0.53*** 0.53***	0.53*** 0.53***	0.53*** 0.53***	0.53*** 0.53***
L-V										1.00 (614)	0.82*** 0.80***	0.77*** 0.76***	0.83*** 0.81***	0.63*** 0.62***	0.35*** 0.36***	0.35*** 0.36***	0.35*** 0.36***	0.10** 0.02	0.42*** 0.37***	0.67*** 0.67***	0.47*** 0.47***	0.67*** 0.67***	0.67*** 0.67***	0.67*** 0.67***	0.67*** 0.67***	0.67*** 0.67***	0.67*** 0.67***
L-CO											1.00 (573)	0.71*** 0.69***	0.79*** 0.77***	0.68*** 0.66***	0.35*** 0.36***	0.35*** 0.36***	0.35*** 0.36***	0.13*** 0.02	0.42*** 0.37***	0.42*** 0.42***	0.42*** 0.42***	0.42*** 0.42***	0.42*** 0.42***	0.42*** 0.42***	0.42*** 0.42***	0.42*** 0.42***	0.42*** 0.42***
L-CR												1.00 (614)	0.85*** 0.85***	0.61*** 0.58***	0.34*** 0.33***	0.34*** 0.33***	0.34*** 0.33***	0.13*** 0.07*	0.42*** 0.42***	0.55*** 0.55***	0.55*** 0.55***	0.55*** 0.55***	0.55*** 0.55***	0.55*** 0.55***	0.55*** 0.55***	0.55*** 0.55***	0.55*** 0.55***
L-NI													1.00 (613)	0.72*** 0.70***	0.42*** 0.40***	0.42*** 0.40***	0.42*** 0.40***	0.13*** 0.02	0.42*** 0.42***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-CU														1.00 (613)	0.57*** 0.58***	0.57*** 0.58***	0.57*** 0.58***	0.13*** 0.02	0.42*** 0.42***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-LI															1.00 (616)	0.13*** 0.12***	0.13*** 0.12***	0.13*** 0.12***	0.42*** 0.42***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-ZN																1.00 (615)	0.13*** 0.12***	0.13*** 0.12***	0.42*** 0.42***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-P																	1.00 (615)	0.13*** 0.12***	0.42*** 0.42***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-Y																		1.00 (614)	0.42*** 0.42***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-MN																			1.00 (614)	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
LTGM																				1.00 (37)	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-TI																					1.00 (614)	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-TH																						1.00 (611)	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-CE																							1.00 (612)	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-AL																								1.00 (615)	0.58*** 0.58***	0.58*** 0.58***	0.58*** 0.58***
L-NA																									1.00 (615)	0.58*** 0.58***	0.58*** 0.58***
L-DE																										1.00 (612)	0.58*** 0.58***
L-NB																											1.00 (590)
L-SR																											

Notes:

(1) Pearson correlation/Spearman correlation/sample size. If either element has concentration level below the detection limit, it is omitted from the pairwize computation.

(2) Significance levels:

* - .10

** - .05

*** - .01

Table B-II. Correlation matrix for variables determined in stream sediment samples.

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
154423	40-41.855	-113.136	-3-15-	2.6	3.0	0.87	<2	4.3	15	530	2	8.3	6	48
154424	40-41.837	-113.146	-3-15-	1.9	3.2	0.59	<2	3.8	25	510	2	6.6	5	50
154425	40-41.917	-113.629	-3-15-	2.9	3.4	0.86	<2	7.1	27	670	3	1.6	13	98
154426	40-41.948	-113.586	-3-15-	2.6	3.0	0.88	<2	4.8	26	660	2	5.6	6	39
154427	40-41.948	-113.570	-3-15-	2.4	2.9	0.84	<2	4.8	22	580	2	7.1	6	50
154428	40-41.941	-113.471	-3-15-	2.6	3.4	0.77	<2	6.2	33	700	2	1.6	8	65
154429	40-41.885	-113.612	-3-15-	2.6	3.1	0.84	<2	6.1	33	740	2	1.1	6	45
154430	40-41.889	-113.619	-3-12-A	2.7	3.5	0.78	<2	6.0	21	750	2	1.5	7	46
154431	40-41.882	-113.635	-3-15-	4.4	4.5	0.98	<2	6.4	29	910	2	1.2	8	44
154432	40-41.876	-113.648	-3-15-	3.6	4.4	0.82	<2	6.2	25	820	2	1.0	9	68
154433	40-41.865	-113.644	-3-15-	3.7	3.9	0.96	<2	6.9	30	910	2	1.1	9	51
154434	40-41.850	-113.658	-3-15-	4.2	3.9	1.1	<2	6.5	25	800	2	1.1	9	52
154435	40-41.941	-113.711	-3-15-	4.2	4.5	0.93	<2	6.6	17	870	3	1.3	7	53
154436	40-41.942	-113.703	-3-15-	4.4	4.9	0.89	<2	7.3	32	890	3	2.3	11	67
154437	40-41.960	-113.664	-3-15-	3.2	4.1	0.77	<2	6.0	23	770	2	3.3	7	47
154438	40-41.986	-113.649	-3-15-	4.1	3.9	1.0	<2	6.5	34	770	2	2.4	6	42
154441	40-41.922	-113.467	-3-15-	3.3	5.6	0.59	<2	5.6	25	720	2	1.0	11	45
154442	40-41.923	-113.438	-3-15-	3.4	4.3	0.80	<2	6.1	24	750	2	0.87	10	48
154443	40-41.918	-113.415	-3-15-	3.9	4.6	0.85	<2	5.9	21	660	2	0.75	9	45
154444	40-41.918	-113.414	-3-12-	2.8	4.0	0.70	<2	5.0	15	610	2	1.0	9	37
154445	40-41.917	-113.414	-3-15-	4.7	5.2	0.90	<2	7.4	22	830	2	0.69	11	81
154446	40-41.905	-113.356	-3-12-	4.3	5.0	0.86	<2	7.8	20	750	3	0.58	9	80
154447	40-41.910	-113.408	-3-15-	5.9	6.0	0.99	<2	7.2	26	750	2	0.80	17	80
154448	40-41.921	-113.414	-3-15-	3.7	5.2	0.72	<2	6.4	24	630	3	1.2	13	53
154449	40-41.931	-113.455	-3-15-	4.8	4.9	0.98	<2	6.2	29	790	3	0.90	11	52
154450	40-42.931	-113.465	-3-91-	2.3	3.4	0.68	<2	4.0	32	600	1	1.8	6	51
154451	40-41.929	-113.470	-3-15-	3.0	3.5	0.85	<2	5.8	29	760	2	1.0	8	50
154452	40-41.928	-113.483	-3-15-	2.1	2.7	0.77	<2	5.2	32	610	2	1.9	6	45
154453	40-41.929	-113.487	-3-12-											
154454	40-41.962	-113.452	-3-15-	2.7	2.6	1.0	<2	4.9	24	550	2	4.9	6	60
154458	40-41.952	-113.318	-3-12-	37.	38.	0.98	<2	6.1	15	550	2	1.6	12	61
154459	40-41.941	-113.319	-3-15-	3.3	3.6	0.91	<2	5.8	29	680	2	1.7	12	59
154460	40-41.948	-113.315	-3-15-	3.1	3.4	0.90	<2	6.0	26	670	2	1.3	11	86
154461	40-42.290	-113.518	-3-15-	9.8	11.	0.91	<2	5.4	<10	630	2	0.94	8	65
154462	40-42.294	-113.535	-3-15-	4.6	4.5	1.0	<2	6.3	21	720	2	1.0	7	60
154463	40-42.318	-113.603	-3-15-	3.1	3.7	0.83	<2	6.0	19	790	2	0.71	8	44
154464	40-42.321	-113.652	-3-14-	1.9	2.4	0.81	<2	3.0	11	350	1	0.24	<4	37
154465	40-42.326	-113.608	-3-15-	3.0	4.4	0.68	<2	6.1	18	770	2	0.49	11	45
154466	40-42.329	-113.596	-3-15-	3.6	4.2	0.85	<2	6.5	25	820	2	0.64	9	51
154467	40-42.333	-113.569	-3-15-	6.8	7.8	0.87	<2	5.6	13	630	2	0.86	8	74
154468	40-42.339	-113.544	-3-15-	3.9	4.6	0.85	<2	4.4	17	620	2	0.64	7	49
154469	40-42.338	-113.542	-3-12-	5.1	5.4	0.94	<2	5.5	23	720	2	0.90	<4	48
154470	40-42.339	-113.529	-3-15-	3.8	4.7	0.80	<2	5.7	23	820	2	0.83	6	53
154471	40-42.257	-113.632	-3-15-	3.2	3.4	0.95	<2	5.0	28	570	2	1.4	5	47
154472	40-42.241	-113.715	-3-15-	2.8	3.9	0.71	<2	4.1	12	400	2	2.1	5	77
154474	40-42.241	-113.719	-3-15-	3.0	3.5	0.86	<2	5.1	23	950	2	1.2	7	62
154475	40-42.245	-113.730	-3-15-	3.1	3.1	0.99	<2	5.4	21	730	2	1.0	7	41
154476	40-42.248	-113.741	-3-15-	2.3	3.1	0.75	<2	5.3	24	700	2	1.2	6	56
154477	40-41.688	-113.720	-3-15-	6.1	7.5	0.82	<2	6.7	<10	710	2	1.5	9	63
154479	40-41.679	-113.707	-3-12-	3.6	6.8	0.54	<2	7.5	<10	600	2	1.8	6	50
154480	40-41.692	-113.697	-3-12-	11.	15.	0.75	<2	7.1	<10	530	2	1.9	7	74
154482	40-41.705	-113.703	-3-12-	7.2	9.8	0.73	<2	7.1	<10	640	2	1.6	8	86
154484	40-41.706	-113.702	-3-12-	16.	18.	0.89	<2	6.9	<10	700	1	1.7	7	98
154486	40-41.709	-113.681	-3-15-	4.8	6.4	0.76	<2	7.8	<10	720	2	1.6	6	23
154487	40-42.134	-113.611	-3-15-	1.9	3.3	0.59	<2	5.2	16	720	2	1.1	6	34

TABLE III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
154423	17	2.2	39	1.3	440	<4	0.56	12	21	640	6	10	2200	54	17
154424	10	1.8	29	1.0	340	<4	0.61	17	16	600	5	5	2300	49	16
154425	33	3.9	37	1.4	750	<4	1.3	24	37	880	11	14	4500	92	25
154426	20	2.0	34	1.5	470	<4	0.84	11	16	690	6	11	2200	53	17
154427	17	2.1	32	1.1	410	<4	0.75	10	16	900	7	7	2400	53	17
154428	24	2.8	45	0.98	750	<4	0.72	6	23	1400	8	9	2400	64	22
154429	24	2.5	43	0.79	500	<4	0.99	8	17	700	7	6	2800	63	20
154430	17	2.5	37	0.71	650	<4	0.87	7	19	700	8	15	2600	61	21
154431	36	2.7	52	0.74	890	<4	0.85	9	26	1300	8	15	2700	64	30
154432	25	2.7	44	0.68	700	<4	0.75	9	23	890	8	9	2900	65	29
154433	30	3.0	49	0.78	830	<4	0.87	8	22	1200	8	9	2900	73	22
154434	30	2.9	47	0.75	750	<4	0.78	9	24	1000	8	10	2900	72	23
154435	20	3.4	33	0.87	720	<4	1.3	47	22	1200	8	18	4700	68	30
154436	34	3.9	42	1.1	590	<4	1.1	13	32	930	11	25	4200	93	26
154437	16	3.1	33	1.2	540	<4	0.81	15	19	1200	8	11	3400	66	28
154438	22	2.7	42	1.0	530	<4	1.3	9	19	900	7	15	2700	58	22
154441	28	3.2	39	0.68	890	<4	0.53	7	22	1900	8	11	2500	62	22
154442	22	3.2	47	0.77	780	<4	0.69	9	19	1400	8	15	2800	71	19
154443	18	2.8	53	0.66	650	<4	0.80	9	17	900	7	17	2900	70	19
154444	11	3.3	34	0.60	540	<4	0.56	5	16	2600	7	8	2000	52	22
154445	29	3.5	67	0.91	660	<4	1.1	6	30	840	10	17	2700	83	21
154446	21	3.4	60	0.91	570	<4	1.1	12	25	1000	11	17	2700	80	15
154447	42	3.8	65	1.2	730	<4	0.98	4	40	1300	11	15	2600	83	29
154448	16	6.5	63	1.5	1100	<4	0.43	6	22	4400	10	11	3100	77	29
154449	24	3.4	50	0.68	890	<4	0.68	9	21	2000	9	13	2900	70	19
154450	26	1.9	37	0.65	550	<4	0.58	5	14	1600	5	11	1600	42	12
154451	24	2.6	39	0.74	700	<4	0.79	7	19	1200	7	18	2500	61	18
154452	21	2.4	38	1.0	660	<4	0.66	6	19	1500	7	11	2200	56	18
154453															
154454	16	2.1	34	2.7	570	<4	0.57	8	16	1100	6	6	2100	52	17
154458	29	4.0	36	1.3	890	<4	1.2	4	34	810	12	12	3900	99	25
154459	42	3.0	41	1.1	750	<4	0.92	6	32	1100	9	6	2700	76	17
154460	34	3.2	39	1.3	700	<4	0.90	7	36	1100	10	12	2500	77	17
154461	24	2.5	24	0.71	540	<4	0.98	6	25	590	9	20	3400	68	20
154462	20	2.7	35	0.78	510	<4	1.0	7	22	730	8	10	3200	74	24
154463	20	2.9	39	0.63	990	<4	0.68	8	21	990	7	10	2900	67	20
154464	8	1.2	15	0.24	290	<4	0.30	4	7	290	3	4	1900	33	7
154465	18	3.3	43	0.62	900	<4	0.58	15	23	790	8	11	4500	69	24
154466	27	3.0	41	0.73	850	<4	0.69	9	21	1600	8	15	3400	70	19
154467	19	2.9	32	0.81	600	<4	0.94	5	41	580	9	13	4600	71	25
154468	21	1.8	19	0.46	450	<4	0.66	7	20	670	6	15	2200	48	23
154469	23	1.9	29	0.52	180	<4	0.79	7	19	690	7	9	2700	57	31
154470	17	2.3	27	0.56	460	<4	0.77	10	18	840	7	12	2800	59	30
154471	22	2.1	37	0.63	560	<4	0.68	6	19	1200	6	8	2200	53	22
154472	11	2.3	25	1.0	380	<4	0.55	14	26	1800	8	11	4200	81	24
154474	33	2.7	33	0.94	810	<4	0.60	5	51	1700	7	9	2500	81	23
154475	21	2.2	29	0.55	570	<4	0.87	8	17	930	6	11	2700	58	21
154476	18	2.3	29	0.71	470	<4	0.82	8	31	1100	7	8	2800	68	21
154477	28	3.0	37	0.94	600	<4	1.8	7	27	560	8	26	2800	55	16
154479	17	2.8	26	0.76	640	<4	2.3	5	19	440	8	22	4000	54	18
154480	17	2.8	26	0.86	630	<4	2.1	5	25	540	9	25	3200	58	18
154482	16	2.9	26	0.81	850	<4	2.0	6	26	610	8	31	2400	52	16
154484	12	2.4	25	0.87	410	<4	2.3	6	23	460	7	28	2200	43	16
154486	23	2.3	22	0.58	400	<4	2.5	7	9	440	7	44	2200	39	21
154487	16	2.1	28	0.66	470	<4	1.0	7	14	740	6	13	2500	49	18

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
154423	60	63	1.4	210	46								
154424	51	55	1.1	200	45								
154425	85	68	1.6	190	89								
154426	80	79	1.4	270	48								
154427	69	52	1.3	240	52								
154428	100	73	1.8	180	65								
154429	79	96	2.0	190	55								
154430	72	63	1.5	220	72								
154431	160	92	1.8	180	76								
154432	95	91	1.5	170	75								
154433	120	94	1.8	200	71								
154434	110	85	1.7	180	78								
154435	95	84	1.8	170	130								
154436	83	59	2.3	180	100								
154437	61	78	2.3	220	85								
154438	82	97	2.0	210	72								
154441	75	56	2.0	180	77								
154442	110	81	1.9	150	86								
154443	79	84	1.6	130	72								
154444	67	46	2.0	120	66								
154445	94	66	1.9	140	86								
154446	88	54	2.1	150	100								
154447	100	69	1.8	140	100								
154448	79	51	2.5	120	97								
154449	90	72	2.2	160	83								
154450	91	49	1.6	180	43								
154451	80	83	2.0	170	71								
154452	88	70	1.8	140	56								
154453													
154454	69	62	1.8	140	45								
154458	78	33	1.5	140	58								
154459	99	62	1.5	190	43								
154460	100	59	1.7	170	52								
154461	60	54	1.6	130	71								
154462	77	85	1.8	160	65								
154463	84	83	1.6	150	73								
154464	39	31	0.92	57	30								
154465	90	73	1.8	130	79								
154466	100	88	2.1	150	82								
154467	59	43	1.7	130	64								
154468	48	66	1.5	120	62								
154469	62	88	1.6	150	70								
154470	63	89	1.9	150	74		9200	6.5	260	9.0	54	31.	39
154471	100	80	1.4	130	44								
154472	85	28	0.93	140	73								
154474	250	70	1.4	120	55								
154475	82	95	1.6	160	60								
154476	94	80	1.5	170	58								
154477	87	32	1.4	150	76								
154479	64	17	1.7	120	62								
154480	68	19	1.6	110	66								
154482	61	20	1.7	110	79								
154484	61	20	1.5	140	76								
154486	89	17	1.6	140	120								
154487	60	66	1.7	170	81		9600	0.4	33	2.7	20	13.	17

TABLE B-III. Analyses of sediment samples

1-c

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
154488	40-	42.128	-113.617	-3-15-	2.0	4.0	0.51	<2	6.0	26	740	2	1.2	8	44
154489	40-	******	-*******	-3- -	3.4	5.7	0.60	<2	5.7	19	720	3	1.6	6	38
154491	40-	42.261	-113.609	-3-15-	2.7	4.6	0.58	<2	5.8	22	760	2	0.79	9	46
154493	40-	42.264	-113.620	-3-12-	12.	13.	0.91	<2	4.2	17	700	2	0.41	<4	36
154494	40-	42.253	-113.621	-3-15-	2.1	3.7	0.56	<2	5.5	23	690	2	0.89	8	70
154495	40-	42.254	-113.607	-3-15-	3.0	4.2	0.70	<2	6.0	25	780	2	1.0	8	47
154496	40-	42.259	-113.599	-3-15-	2.4	4.8	0.51	<2	5.0	22	680	2	0.98	9	41
154497	40-	42.259	-113.576	-3-15-	2.6	6.4	0.40	<2	4.4	18	620	2	0.69	7	54
154515	40-	41.800	-113.664	-3-15-	3.8	4.6	0.82	<2	7.0	30	840	2	0.97	8	48
154518	40-	41.808	-113.615	-3-12-	4.8	5.8	0.84	<2	6.0	22	760	2	1.1	8	50
154519	40-	41.805	-113.594	-3-15-	2.6	3.6	0.72	<2	5.5	12	600	2	4.2	4	43
154521	40-	41.743	-113.672	-3-12-	4.6	6.1	0.75	<2	6.3	12	600	2	3.4	7	56
154528	40-	41.932	-113.596	-3-12-	2.6	3.4	0.77	<2	6.0	14	600	2	1.6	6	46
154531	40-	41.932	-113.561	-3-12-	3.9	6.9	0.56	<2	7.9	<10	620	2	1.3	7	76
154540	40-	41.739	-113.759	-3-12-	8.8	9.8	0.89	<2	6.6	<10	560	2	1.7	7	37
154543	40-	41.741	-113.750	-3-12-	9.1	11.	0.85	<2	6.5	21	730	2	1.3	7	45
154545	40-	41.731	-113.786	-3-12-	3.7	6.7	0.56	<2	5.9	<10	770	2	1.8	13	59
154548	40-	41.718	-113.785	-3-15-	6.7	8.3	0.81	<2	6.9	14	650	3	1.2	11	74
154549	40-	41.708	-113.791	-3-15-	8.1	9.4	0.87	<2	7.2	10	600	3	1.8	9	54
154556	40-	41.706	-113.734	-3-15-	2.8	3.2	0.87	<2	1.8	13	200	<1	23.	<4	15
154560	40-	41.810	-113.688	-3-12-	3.4	4.7	0.73	<2	6.9	13	750	3	0.95	7	49
154562	40-	41.797	-113.641	-3-15-	3.0	4.3	0.70	<2	6.7	20	700	2	1.1	10	56
154565	40-	41.773	-113.649	-3-15-	3.2	4.3	0.75	<2	6.3	13	600	2	1.4	11	72
154567	40-	41.795	-113.626	-3-15-	2.8	4.4	0.63	<2	6.4	23	720	2	0.85	7	46
154569	40-	41.797	-113.602	-3-15-	2.5	4.8	0.52	<2	5.5	21	710	2	0.97	7	45
154570	40-	41.790	-113.593	-3-15-	2.3	3.9	0.59	<2	5.5	22	630	2	0.88	6	35
154575	40-	41.682	-113.724	-3-15-	3.0	6.4	0.46	<2	7.9	<10	690	2	1.3	5	27
154577	40-	41.688	-113.726	-3-12-	24.	36.	0.68	<2	6.7	<10	610	3	1.9	11	110
154578	40-	41.691	-113.724	-3-15-	18.	20.	0.89	<2	7.7	<10	650	3	1.5	10	85
154580	40-	41.702	-113.720	-3-12-	13.	14.	0.91	<2	8.1	<10	710	2	1.7	4	37
154582	40-	41.709	-113.713	-3-12-	12.	16.	0.74	<2	7.2	<10	640	2	1.6	7	71
154583	40-	41.990	-113.817	-3-15-	5.5	12.	0.45	<2	6.0	16	800	2	1.1	6	36
154584	40-	41.994	-113.841	-3-15-	6.4	13.	0.50	<2	6.2	12	740	2	1.2	6	27
154586	40-	41.983	-113.864	-3-12-	13.	13.	1.0	<2	6.4	15	740	2	1.2	4	31
154591	40-	41.959	-113.858	-3-15-	3.4	3.4	1.0	<2	3.6	20	470	1	4.7	<4	54
154592	40-	41.814	-113.654	-3-15-	4.6	4.8	0.95	<2	6.3	20	720	2	0.88	7	44
154593	40-	41.794	-113.660	-3-15-	3.9	4.3	0.91	<2	6.8	20	720	2	1.2	11	59
154594	40-	41.806	-113.662	-3-15-	4.1	4.9	0.84	<2	6.7	21	730	2	0.86	7	46
154598	40-	41.901	-113.769	-3-12-	7.9	12.	0.66	<2	6.0	13	800	3	1.4	8	39
154603	40-	41.936	-113.789	-3-12-	1.7	4.9	0.34	<2	6.4	<10	940	3	2.2	4	32
154605	40-	41.952	-113.776	-3-12-	3.5	19.	0.18	<2	6.4	<10	1100	3	2.4	<4	22
154606	40-	41.961	-113.777	-3-15-	3.5	5.8	0.61	<2	6.6	16	910	2	2.2	4	26
154608	40-	42.286	-113.571	-3-15-	2.6	4.6	0.56	<2	5.8	19	870	2	0.61	11	44
154611	40-	42.286	-113.586	-3-15-	3.2	5.2	0.61	<2	5.4	16	760	2	0.63	9	50
154613	40-	42.284	-113.594	-3-15-	2.3	4.3	0.53	<2	5.8	15	910	2	0.77	11	55
154615	40-	41.786	-113.591	-3-15-	3.4	4.4	0.78	<2	5.0	23	610	2	0.85	6	36
154618	40-	41.770	-113.609	-3-15-	1.8	4.4	0.42	<2	4.8	15	600	2	0.81	7	40
154619	40-	41.752	-113.616	-3-15-	2.3	3.6	0.65	<2	5.8	<10	540	2	2.9	13	70
154620	40-	41.750	-113.642	-3-15-	2.7	3.7	0.74	<2	5.3	16	590	2	1.1	8	50
154622	40-	41.757	-113.664	-3-12-	3.5	3.6	0.98	<2	5.3	16	540	2	1.1	6	66
154624	40-	41.751	-113.677	-3-12-	2.8	3.0	0.93	<2	5.7	18	530	2	1.9	9	87
154626	40-	41.751	-113.687	-3-15-	7.2	6.9	1.0	<2	7.9	<10	720	2	1.3	11	79
154628	40-	41.751	-113.693	-3-12-	2.4	3.5	0.70	<2	6.4	15	570	2	1.4	9	83
154631	40-	41.951	-113.344	-3-91-	3.5	4.4	0.79	<2	6.6	18	750	2	1.2	8	52
154632	40-	41.955	-113.356	-3-91-	3.4	4.1	0.82	<2	5.6	29	740	2	1.2	7	44

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
154488	22	2.9	33	0.85	550	<4	0.80	8	19	960	8	13	3000	61	21
154489	16	3.0	27	0.73	520	<4	0.90	12	16	1700	8	15	3300	55	28
154491	20	2.9	27	0.62	640	<4	0.64	8	19	970	8	10	3000	67	20
154493	6	2.6	10	0.30	120	<4	0.24	4	11	1100	5	5	2200	40	10
154494	23	2.8	30	0.76	690	<4	0.59	7	21	1200	8	6	2600	64	21
154495	22	2.6	36	0.71	630	<4	0.86	7	17	810	8	12	3000	68	22
154496	19	2.3	28	0.62	750	<4	0.76	8	17	710	7	10	2700	56	19
154497	9	2.9	19	0.46	400	<4	0.53	6	14	690	6	14	2700	53	16
154515	29	3.0	49	0.80	890	<4	1.1	17	21	1400	8	6	3300	69	19
154518	21	2.7	34	0.80	460	<4	0.91	9	20	800	8	16	3000	63	23
154519	12	2.2	28	0.81	470	<4	1.1	16	15	880	8	13	4100	62	18
154521	20	3.0	26	0.79	470	<4	1.2	9	23	960	9	17	4100	75	20
154528	17	2.7	30	0.78	410	<4	1.5	23	19	880	9	16	4000	71	20
154531	20	2.9	43	0.51	560	<4	2.1	8	24	630	8	25	3000	57	15
154540	15	2.5	22	0.66	750	<4	2.1	5	17	750	8	24	2300	49	15
154543	25	2.6	41	0.70	430	<4	1.3	9	18	790	8	13	3000	58	21
154545	20	5.2	27	0.82	3000	<4	1.5	8	24	1900	9	19	5300	83	21
154548	37	3.8	38	1.1	570	<4	0.70	7	35	1100	10	12	3400	89	19
154549	25	3.1	42	0.85	650	<4	1.9	7	24	690	9	18	3100	67	16
154556	6	0.68	19	0.59	160	<4	0.22	13	8	400	2	6	720	25	6
154560	21	3.0	30	0.81	500	<4	1.4	20	25	1000	8	26	3600	69	21
154562	30	3.2	41	0.86	810	<4	0.95	10	25	1100	9	16	3500	77	21
154565	33	3.6	35	1.0	790	<4	1.1	8	30	1100	12	15	4800	99	23
154567	17	2.8	33	0.70	630	<4	0.70	10	19	1100	8	12	3200	63	22
154569	18	2.4	32	0.67	650	<4	0.79	9	15	1000	8	14	3100	59	22
154570	17	2.1	35	0.60	550	<4	0.86	7	15	560	6	9	2600	55	17
154575	21	2.0	40	0.52	380	<4	2.5	6	12	550	5	34	1900	34	11
154577	42	2.5	40	1.2	580	<4	1.9	<4	41	640	9	20	2500	57	19
154578	42	3.3	46	0.57	670	<4	1.9	6	32	720	9	35	3000	63	19
154580	10	2.0	23	0.60	360	<4	2.5	7	13	430	7	44	2300	38	19
154582	19	2.7	32	0.84	490	<4	2.1	6	22	520	8	27	2500	52	19
154583	20	2.4	30	0.60	610	<4	1.1	13	13	760	7	35	2900	51	29
154584	13	2.3	22	0.53	800	<4	1.3	12	11	810	6	16	2600	44	20
154586	14	2.0	31	0.61	460	<4	1.3	11	14	810	5	8	2200	43	20
154591	11	1.5	24	1.1	770	<4	0.43	8	17	1100	4	9	1600	50	17
154592	21	2.4	27	0.61	540	<4	1.0	11	16	740	8	15	3300	59	20
154593	35	3.2	42	0.50	880	<4	1.0	10	25	1300	10	15	3700	80	21
154594	26	2.7	32	0.75	560	<4	1.1	10	20	890	8	23	2800	61	24
154598	15	2.8	33	0.65	1700	<4	1.3	29	16	910	7	16	3600	56	20
154603	11	2.0	36	0.77	460	<4	1.7	11	12	690	5	17	2700	42	17
154605	5	1.3	21	0.64	460	<4	2.0	15	4	1000	4	33	2000	25	24
154606	14	2.0	34	0.77	470	<4	1.6	17	11	1000	5	9	2400	38	17
154608	23	2.8	29	0.60	590	<4	0.48	6	20	1300	9	4	2900	58	18
154611	20	2.9	24	0.55	480	<4	0.38	6	27	1300	9	13	2500	55	27
154613	23	2.7	38	0.66	850	<4	0.73	7	23	1100	8	10	2800	60	18
154615	19	1.8	27	0.54	560	<4	0.73	8	13	630	6	13	2300	50	15
154618	17	2.1	29	0.64	650	<4	0.66	8	17	540	6	12	2600	54	18
154619	48	4.2	28	1.3	880	<4	1.1	10	33	1200	15	14	6900	130	26
154620	23	2.5	24	0.72	750	<4	0.89	7	19	640	8	11	3700	71	20
154622	19	2.4	24	0.80	270	<4	0.81	7	25	710	8	12	3000	77	17
154624	30	3.0	33	0.56	460	<4	0.65	5	37	1200	9	3	2700	81	21
154626	32	4.1	32	1.1	800	<4	1.3	11	37	1300	12	13	5300	100	24
154628	25	3.4	37	0.93	610	<4	0.71	6	37	1200	11	5	3600	95	19
154631	25	2.7	34	0.83	640	<4	1.4	15	23	780	8	27	2800	59	28
154632	24	2.4	34	0.78	720	<4	0.80	6	16	1100	7	7	2500	59	18

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TUT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
154488	74	81	2.0	180	67								
154489	57	51	2.2	210	120								
154491	65	74	2.1	160	86								
154493	22	18	2.7	150	61								
154494	86	68	1.8	130	73								
154495	81	93	1.8	190	75								
154496	69	82	1.5	150	66								
154497	42	58	1.8	150	69								
154515	150	74	2.0	160	68								
154518	79	80	1.5	170	84								
154519	56	39	1.4	200	79								
154521	71	25	1.4	140	66								
154528	72	40	1.5	170	81								
154531	75	32	1.7	110	68								
154540	59	22	1.3	130	56								
154543	88	83	1.3	170	72								
154545	83	42	1.1	140	79								
154548	88	47	1.8	110	71								
154549	77	35	1.5	120	52								
154556	22	40	0.58	700	<10								
154560	75	28	2.0	130	100								
154562	97	62	1.8	150	76	1100							
154565	88	41	1.3	170	84								
154567	74	69	2.1	140	83								
154569	74	64	1.7	160	89								
154570	67	78	1.6	150	59								
154575	65	27	1.5	160	90								
154577	110	23	1.4	140	68								
154578	99	28	1.8	120	84								
154580	50	16	1.9	130	100								
154582	69	23	1.5	130	81								
154583	77	94	1.5	170	160								
154584	62	54	1.8	140	84								
154586	77	74	1.8	150	61								
154591	93	50	1.0	140	37								
154592	68	68	1.8	150	73								
154593	99	50	2.0	160	79								
154594	79	61	2.2	140	80								
154598	82	49	1.4	180	79								
154603	64	28	1.4	260	110								
154605	54	28	1.5	290	320								
154606	70	54	1.8	220	82								
154608	59	44	2.8	170	73								
154611	58	43	2.3	150	83								
154613	77	54	2.3	190	64								
154615	60	63	1.6	160	60								
154618	68	77	1.3	150	79								
154619	77	41	1.1	200	79								
154620	71	58	1.3	170	73								
154622	70	32	1.3	150	58								
154624	110	44	1.4	160	44								
154626	91	24	1.8	170	77								
154628	99	35	1.5	150	51								
154631	86	62	2.0	190	100								
154632	86	73	1.8	190	59								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
154633	40-41.954	-113.323	-3-91-		2.3	2.9	0.80	<2	5.9	17	590	2	1.6	13	63
154634	40-41.953	-113.300	-3-15-		3.0	3.6	0.84	<2	5.8	21	590	2	1.6	15	86
154636	40-41.956	-113.291	-3-15-		6.0	6.8	0.88	<2	5.9	20	580	2	1.7	13	100
154637	40-41.963	-113.281	-3-15-		2.2	2.9	0.75	<2	6.2	11	540	2	1.8	19	120
154638	40-41.949	-113.156	-3-15-		3.3	2.6	1.3	<2	4.2	26	570	1	4.9	4	37
154639	40-41.906	-113.139	-3-15-		3.1	3.9	0.81	<2	3.7	29	640	2	8.1	<4	24
154640	40-41.892	-113.136	-3-15-		2.0	2.5	0.81	<2	4.2	32	550	2	7.8	4	33
154641	40-41.665	-113.136	-3-15-		2.2	4.1	0.54	<2	3.0	13	380	1	6.9	4	39
154642	40-41.821	-113.192	-3-15-		2.2	3.1	0.72	<2	4.8	22	500	2	3.1	7	59
154643	40-41.817	-113.242	-3-15-		2.3	2.6	0.90	<2	4.3	52	550	2	7.1	5	44
154644	40-41.821	-113.271	-3-15-		2.1	6.2	0.34	<2	4.7	32	560	2	3.8	6	51
154645	40-41.671	-113.252	-3-15-		2.5	2.4	1.0	<2	4.1	25	510	1	6.3	5	45
154647	40-41.843	-113.394	-3-15-		3.8	4.6	0.84	<2	6.1	21	700	2	0.88	8	46
154648	40-41.859	-113.422	-3-15-		3.1	4.0	0.77	<2	5.1	<10	870	2	0.22	<4	14
154649	40-41.867	-113.420	-3-15-		4.8	5.1	0.93	<2	5.7	25	730	2	0.94	6	39
154650	40-41.999	-113.354	-3-15-		2.2	3.5	0.64	<2	5.3	33	710	2	2.8	8	50
154651	40-41.988	-113.353	-3-15-		3.8	5.0	0.76	<2	5.4	29	670	2	1.1	7	45
154652	40-41.983	-113.353	-3-15-		5.8	7.1	0.81	<2	5.7	32	740	2	1.2	7	46
154653	40-41.985	-113.360	-3-15-		13.	15.	0.89	<2	5.6	28	670	2	1.0	9	49
154654	40-41.983	-113.374	-3-15-		2.7	4.0	0.67	<2	6.3	25	840	2	1.4	11	52
154656	40-41.965	-113.375	-3-15-		2.7	3.7	0.72	<2	6.1	31	790	2	1.1	8	53
154657	40-41.975	-113.378	-3-15-		5.3	7.4	0.72	<2	5.1	27	650	2	1.3	7	44
154658	40-41.985	-113.405	-3-15-		7.2	4.1	1.8	<2	6.0	19	650	2	1.5	11	62
154659	40-41.967	-113.407	-3-15-		3.2	5.1	0.64	<2	6.4	26	790	3	1.0	8	56
154660	40-41.962	-113.415	-3-15-		5.0	6.4	0.79	<2	5.2	25	660	2	1.3	7	40
154661	40-41.972	-113.431	-3-15-		2.6	3.0	0.87	<2	5.3	23	600	2	6.4	6	50
154662	40-41.968	-113.441	-3-15-		1.6	2.1	0.74	<2	4.3	14	480	1	10.	5	38
154663	40-41.958	-113.454	-3-15-		0.77	1.1	0.70	<2	1.6	<10	170	1	16.	<4	18
154664	40-41.951	-113.463	-3-15-		2.8	2.8	1.0	<2	4.5	46	650	2	1.6	5	97
154665	40-41.948	-113.472	-3-91-		2.0	3.1	0.65	<2	4.3	38	560	1	2.2	6	56
154666	40-41.811	-113.532	-3-15-		1.7	2.0	0.85	<2	3.7	17	430	1	7.1	5	34
154667	40-41.816	-113.564	-3-15-		2.2	2.4	0.92	<2	5.0	37	610	2	5.4	6	53
154668	40-41.786	-113.582	-3-15-		2.9	4.4	0.65	<2	5.2	23	680	2	0.97	8	39
154669	40-41.822	-113.615	-3-15-		3.7	4.4	0.85	<2	5.9	38	680	2	4.4	9	59
154670	40-41.938	-113.391	-3-15-		4.3	5.2	0.82	<2	5.9	30	730	2	0.74	9	45
154671	40-41.931	-113.346	-3-15-		41.	41.	1.0	<2	5.8	25	690	2	0.79	9	46
154674	40-41.950	-113.383	-3-91-		2.8	4.2	0.67	<2	6.0	32	800	2	1.0	8	50
154675	40-41.946	-113.381	-3-15-		4.5	6.4	0.70	<2	6.3	29	720	3	0.64	8	52
154676	40-41.953	-113.369	-3-91-		3.5	4.0	0.86	<2	5.0	30	700	2	1.3	8	41
154677	40-41.957	-113.361	-3-15-		4.8	5.9	0.81	<2	5.8	29	690	2	0.97	10	52
154678	40-41.962	-113.383	-3-15-		12.	12.	0.97	<2	5.7	26	660	2	1.1	9	48
154679	40-41.966	-113.379	-3-15-		5.3	6.7	0.79	<2	5.9	29	660	2	0.94	8	51
154680	40-41.965	-113.374	-3-15-		3.0	3.5	0.85	<2	5.5	33	680	2	1.6	9	48
154692	40-41.930	-113.340	-3-15-		73.	72.	1.0	<2	5.7	21	710	2	1.0	7	37
154694	40-41.922	-113.331	-3-15-		87.	100.	0.85	<2	5.9	19	570	2	0.89	10	49
154697	40-41.924	-113.324	-3-12-		16.	18.	0.90	<2	5.7	<10	440	2	1.9	18	77
154699	40-41.894	-113.322	-3-12-		32.	32.	1.00	<2	5.8	24	620	2	1.8	11	61
154701	40-41.939	-113.326	-3-12-		45.	47.	0.97	<2	5.8	15	570	2	1.5	10	55
154703	40-41.947	-113.454	-3-12-		3.6	4.9	0.73	<2	6.3	23	770	2	1.1	8	60
154705	40-41.943	-113.425	-3-12-		1.9	2.8	0.67	<2	3.1	10	400	1	5.9	4	27
154707	40-41.935	-113.428	-3-12-		13.	16.	0.85	<2	5.7	25	750	2	0.98	8	45
154709	40-41.943	-113.421	-3-12-		2.4	4.9	0.49	<2	4.1	13	580	1	1.0	<4	33
154711	40-41.943	-113.420	-3-12-		2.7	4.2	0.64	<2	4.9	15	650	2	1.3	5	41
154714	40-41.941	-113.363	-3-12-		14.	16.	0.84	<2	5.4	22	620	2	1.5	9	52
154715	40-41.868	-113.341	-3-12-		6.4	8.6	0.74	<2	5.3	17	540	2	1.7	13	70

TABLE B-III. Analyses of sediment samples

3-a

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
154633	39	3.8	34	1.2	700	<4	1.1	7	31	590	12	11	3600	100	17
154634	43	3.6	35	1.2	730	<4	0.98	4	43	960	11	7	2900	91	17
154636	45	3.7	34	1.4	510	<4	1.2	<4	50	850	12	7	2900	96	17
154637	53	4.5	37	1.6	880	<4	1.1	<4	53	800	15	5	3400	120	18
154638	14	1.8	33	1.4	440	<4	0.62	8	14	750	5	8	1900	47	15
154639	7	1.3	66	1.2	290	<4	0.33	16	9	420	3	10	1600	28	24
154640	14	1.8	40	1.8	450	<4	0.49	11	14	810	5	10	1700	43	18
154641	11	2.9	24	1.3	530	<4	0.37	15	17	550	5	10	5300	60	16
154642	17	2.7	28	1.1	520	<4	1.0	10	24	780	8	5	3400	68	16
154643	15	1.9	40	1.2	420	<4	0.65	12	17	860	5	8	2000	49	16
154644	17	2.0	32	1.6	540	<4	0.65	12	19	1000	6	13	2300	53	16
154645	14	1.8	33	0.91	390	<4	0.56	10	14	650	5	5	1900	48	15
154647	28	2.7	36	0.78	680	<4	1.1	17	20	790	8	12	2900	66	17
154648	7	1.0	9	0.20	170	<4	1.4	7	6	420	2	20	770	17	10
154649	25	2.5	45	0.65	720	<4	1.0	15	15	1200	6	9	2700	58	18
154650	19	2.8	37	1.1	610	<4	0.65	9	23	1100	7	13	2700	65	19
154651	19	2.6	37	0.87	550	<4	0.78	8	19	920	7	11	2600	61	19
154652	24	2.6	35	0.79	550	<4	0.87	7	19	1100	7	9	2600	60	18
154653	24	3.0	32	0.75	420	<4	0.53	6	20	1400	8	13	2600	65	18
154654	25	3.2	34	1.0	750	<4	0.67	6	23	1100	8	20	3100	72	18
154656	25	2.6	39	0.83	740	<4	0.79	8	18	1000	8	16	2900	66	17
154657	30	2.4	34	0.75	620	<4	0.53	6	25	990	7	13	2200	58	25
154658	27	3.5	40	1.0	670	<4	0.80	5	31	1300	11	9	3300	85	22
154659	34	3.1	35	0.79	690	<4	0.59	8	24	1000	9	16	3100	69	24
154660	24	2.3	35	0.75	530	<4	0.71	6	20	1100	7	8	2200	56	17
154661	17	2.3	38	1.0	440	<4	0.60	6	17	680	7	9	1800	56	16
154662	13	1.7	31	3.5	500	<4	0.47	7	13	710	5	10	1700	44	13
154663	6	0.87	15	3.5	280	<4	0.15	10	5	580	2	2	640	20	7
154664	21	2.0	36	1.1	470	<4	0.51	5	40	1600	7	2	2000	79	23
154665	20	2.0	34	0.92	570	<4	0.59	6	23	1400	6	11	1900	56	19
154666	14	1.8	27	3.3	450	<4	0.46	9	14	800	5	5	1600	41	13
154667	21	2.0	44	1.2	530	<4	0.63	8	25	1100	7	4	2100	57	18
154668	19	2.3	26	0.65	700	<4	0.75	8	15	790	7	13	2800	58	21
154669	21	2.7	40	1.2	630	<4	1.3	10	27	640	9	20	3200	69	25
154670	22	2.8	47	0.71	740	<4	0.69	8	17	1600	8	10	2800	69	17
154671	22	2.6	47	0.68	740	<4	0.64	8	20	1000	8	17	2400	61	29
154674	27	2.5	48	0.73	690	<4	0.76	7	18	1400	8	10	2700	62	17
154675	20	3.1	40	0.66	610	<4	0.48	6	22	1100	9	13	2900	70	28
154676	29	2.2	45	0.72	810	<4	0.70	7	19	1300	7	16	2300	58	15
154677	31	2.7	43	0.71	710	<4	0.57	8	32	1000	8	15	2800	68	61
154678	30	2.6	43	0.71	640	<4	0.64	8	29	850	8	17	2600	63	39
154679	27	2.6	43	0.71	600	<4	0.68	6	25	910	8	12	2700	65	31
154680	25	2.6	36	0.87	780	<4	0.64	8	19	1200	8	12	2400	62	17
154692	21	2.5	50	0.68	690	<4	0.98	8	18	960	6	23	2400	54	45
154694	25	3.4	43	0.96	580	<4	0.84	9	23	930	9	20	2700	73	33
154697	55	4.8	32	1.6	860	<4	1.1	<4	49	760	15	11	3800	130	18
154699	67	3.3	39	1.2	460	<4	0.82	<4	43	700	11	6	3300	86	16
154701	29	3.4	37	1.1	640	<4	1.1	6	28	780	10	17	3400	86	29
154703	26	3.5	39	0.81	620	<4	0.56	5	22	1400	10	12	2600	65	21
154705	7	1.6	18	2.9	280	<4	0.37	6	11	1200	4	8	1400	33	12
154707	22	3.0	37	0.69	630	<4	0.64	7	19	1300	7	12	2500	59	23
154709	6	1.5	17	0.43	160	<4	0.71	6	7	1200	5	13	2200	38	16
154711	8	2.0	24	0.57	690	<4	0.68	5	12	1100	6	10	2000	47	15
154714	27	2.8	36	0.86	620	<4	0.75	4	28	750	9	11	2700	71	20
154716	23	3.8	31	1.1	720	<4	0.66	5	34	1200	11	9	2900	91	20

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
154633	84	70	1.5	180	46								
154634	91	52	1.5	160	46								
154636	86	44	1.4	150	38								
154637	93	49	1.6	140	35								
154638	64	71	1.3	220	40								
154639	51	130	1.4	330	56								
154640	58	78	1.5	210	41								
154641	57	58	0.98	150	37								
154642	60	43	1.3	180	45								
154643	68	72	1.3	250	39								
154644	76	58	1.5	160	58								
154645	62	59	1.2	210	37								
154647	96	71	1.7	170	67								
154648	22	9	2.6	91	43								
154649	100	72	1.7	160	66								
154650	84	79	1.7	190	70								
154651	77	80	1.8	170	68								
154652	89	80	1.9	190	66								
154653	68	60	2.1	160	84								
154654	68	68	2.3	190	82								
154656	91	81	1.9	190	69								
154657	78	64	1.4	160	75								
154658	74	57	1.8	180	65								
154659	73	57	2.3	170	110								
154660	96	75	1.4	170	56								
154661	64	42	1.6	290	63								
154662	48	42	1.3	200	55								
154663	19	18	0.66	92	16								
154664	150	71	1.3	150	42								
154665	120	73	1.3	170	48								
154666	58	46	1.0	130	42								
154667	100	74	1.5	210	45								
154668	69	74	1.4	160	78								
154669	73	71	1.6	270	92								
154670	100	83	1.7	160	80								
154671	79	66	1.7	150	85								
154674	100	73	2.0	190	61								
154675	66	58	2.1	150	72								
154676	82	70	1.4	190	62								
154677	78	78	1.6	160	87								
154678	72	75	1.4	170	86								
154679	69	65	2.1	160	78								
154680	85	65	1.7	160	74								
154692	79	54	1.7	150	71								
154694	78	36	1.5	120	71								
154697	94	24	1.1	130	37								
154699	110	48	1.1	170	38								
154701	76	37	1.5	140	61								
154703	72	44	2.0	180	88								
154705	38	37	1.3	120	47								
154707	93	61	2.1	150	89								
154709	30	49	1.7	160	78								
154711	50	34	1.8	170	80								
154714	61	49	1.6	160	52								
154716	64	35	1.5	160	57								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
154729	40-******	-*******	-3- -											
154730	40-41.883	-113.193	-3-15-	2.3	3.0	0.77	<2	6.1	30	620	2	3.8	12	80
154731	40-41.884	-113.177	-3-15-	1.7	2.1	0.80	<2	2.6	15	320	1	12.	4	30
154732	40-41.872	-113.189	-3-91-	2.2	2.6	0.85	<2	4.0	31	480	1	5.9	6	40
154735	40-41.887	-113.210	-3-15-	2.4	3.4	0.70	<2	6.1	16	550	2	1.8	16	120
154736	40-41.887	-113.211	-3-15-	2.7	3.8	0.71	<2	6.0	23	750	2	1.1	9	52
154738	40-41.884	-113.214	-3-12-	3.0	3.7	0.81	<2	5.4	32	660	2	1.2	9	55
154740	40-41.882	-113.217	-3-15-	2.4	3.2	0.74	<2	5.7	41	660	2	1.5	9	59
154742	40-41.931	-113.253	-3-12-	2.5	3.6	0.70	<2	5.6	16	510	2	1.9	15	68
154744	40-41.928	-113.206	-3-15-	2.8	3.1	0.90	<2	5.9	25	640	2	1.5	14	79
154747	40-41.921	-113.207	-3-12-	6.1	7.6	0.80	<2	6.0	12	590	2	1.5	15	120
154749	40-41.926	-113.201	-3- -											
154750	40-41.926	-113.201	-3-12-	3.0	3.7	0.82	<2	6.6	15	590	2	1.5	16	120
154751	40-41.922	-113.198	-3-15-	4.4	4.9	0.90	<2	6.1	16	570	2	1.3	14	130
154753	40-41.928	-113.191	-3-15-	1.9	2.6	0.75	<2	5.1	24	560	2	4.1	9	66
154754	40-41.938	-113.289	-3-91-	3.9	4.0	0.97	<2	6.0	31	800	2	1.3	8	52
154755	40-41.939	-113.336	-3-15-	31.	31.	0.99	<2	6.0	27	690	2	1.3	7	48
154757	40-41.941	-113.338	-3-12-	13.	13.	1.0	<2	5.6	23	760	2	1.1	7	57
154758	40-41.947	-113.333	-3-15-	2.9	4.2	0.69	<2	6.0	28	760	2	1.1	9	47
154759	40-41.951	-113.289	-3-15-	3.6	4.1	0.87	<2	6.2	31	820	2	1.1	9	60
154760	40-41.948	-113.283	-3-15-	3.0	4.1	0.74	<2	6.0	29	770	2	1.1	8	48
154762	40-41.947	-113.279	-3-15-	3.4	3.8	0.88	<2	5.9	34	750	2	1.4	8	58
154763	40-41.947	-113.278	-3-15-	2.4	3.3	0.74	<2	6.3	27	800	2	1.4	9	50
154764	40-41.943	-113.270	-3-15-	3.8	4.8	0.79	<2	5.8	25	730	2	1.2	9	86
154765	40-41.869	-113.242	-3-15-	2.5	3.8	0.67	<2	4.9	23	530	2	3.2	9	94
154767	40-41.871	-113.254	-3-12-	2.7	4.6	0.58	<2	5.1	16	580	2	1.5	7	74
154769	40-41.874	-113.251	-3-12-	2.6	3.7	0.70	<2	6.2	<10	390	2	2.3	16	120
154770	40-41.898	-113.287	-3-12-	0.72			<2	17.	16	28	<1	21.	<4	<1
154773	40-41.898	-113.283	-3-12-	2.5	3.1	0.82	<2	5.9	<10	470	2	2.7	23	78
154775	40-41.885	-113.258	-3-12-	3.7	4.3	0.85	<2	6.7	<10	460	2	1.9	15	110
154777	40-41.884	-113.261	-3-12-	2.3	3.2	0.73	<2	6.2	<10	390	2	2.8	21	73
154779	40-41.903	-113.251	-3-12-	6.8	7.9	0.87	<2	6.3	12	570	2	1.4	13	110
154780	40-41.829	-113.525	-3-15-	3.1	5.0	0.62	<2	6.6	19	680	2	2.0	8	57
154781	40-41.849	-113.553	-3-15-	4.1	5.2	0.79	<2	6.2	23	680	2	0.91	10	53
154785	40-41.845	-113.515	-3-12-	6.6	8.4	0.79	<2	5.0	11	590	2	0.83	5	39
154787	40-41.817	-113.611	-3-12-	3.2	5.0	0.63	<2	5.8	13	650	2	1.3	6	48
154789	40-41.837	-113.619	-3-12-	3.3	4.7	0.70	<2	6.7	18	750	2	1.2	9	61
154792	40-42.315	-113.702	-3-12-	2.4	3.9	0.62	<2	4.4	<10	420	2	0.35	9	43
154794	40-42.286	-113.744	-3-12-	2.4	3.4	0.71	<2	4.4	13	630	2	1.5	5	35
154795	40-42.270	-113.723	-3-15-	3.0	3.2	0.93	<2	5.4	20	700	2	1.1	7	42
154796	40-42.261	-113.729	-3-15-	2.5	3.1	0.82	<2	5.3	17	750	2	0.98	5	38
154798	40-42.336	-113.694	-3-12-	4.5	12.	0.38	<2	4.8	<10	450	2	1.3	4	61
154801	40-42.343	-113.517	-3-15-	2.8	4.2	0.66	<2	5.8	23	800	2	0.91	7	51
154802	40-42.340	-113.513	-3-15-	3.6	4.7	0.76	<2	5.3	21	740	2	0.75	7	44
154804	40-42.279	-113.564	-3-12-	2.0	3.8	0.53	<2	5.6	17	790	2	0.57	11	70
154805	40-42.279	-113.537	-3-15-	2.4	3.4	0.72	<2	5.3	23	740	2	1.0	7	44
154806	40-42.265	-*******	-3-12-	2.3	4.9	0.46	<2	4.8	19	770	2	0.35	5	42
154808	40-42.140	-113.593	-3-15-	3.8	4.9	0.78	<2	5.0	22	830	2	8.2	5	24
154812	40-42.227	-113.580	-3-15-	3.9	6.6	0.58	<2	4.7	14	670	2	1.8	8	51
154814	40-42.269	-113.584	-3-15-	2.8	5.3	0.53	<2	5.8	26	840	2	0.58	8	57
154816	40-41.928	-113.557	-3-15-	1.9	2.7	0.70	<2	5.4	34	720	2	1.6	7	47
154818	40-41.918	-113.562	-3-12-	1.6	1.8	0.92	<2	1.9	<10	280	1	26.	<4	24
154820	40-41.917	-113.563	-3-12-	2.1	3.3	0.63	<2	4.5	<10	430	2	11.	7	42
154821	40-41.912	-113.559	-3-15-	2.0	2.8	0.70	<2	4.7	14	540	2	8.6	6	41
154825	40-42.176	-113.678	-3-12-	3.9	5.1	0.76	<2	7.1	<10	1300	3	1.4	4	21

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
154729															
154730	31	3.2	44	1.5	730	<4	0.96	7	35	830	10	8	3200	83	18
154731	9	1.2	23	1.8	300	<4	0.24	10	13	470	4	4	1100	31	12
154732	16	1.8	32	0.56	440	<4	0.46	9	18	780	5	6	1600	47	13
154735	44	3.8	36	1.7	740	<4	1.3	9	56	800	13	14	4000	100	18
154736	23	3.0	39	0.91	730	<4	1.0	20	23	820	8	9	3100	69	20
154738	24	2.5	36	0.90	500	<4	0.92	22	26	890	8	16	2900	68	19
154740	26	2.5	40	1.0	670	<4	0.71	11	30	930	9	11	2500	67	19
154742	35	3.8	27	1.3	680	<4	1.2	<4	43	740	15	13	3500	110	17
154744	42	3.3	38	1.2	840	<4	0.95	5	46	1100	11	11	2800	86	18
154747	81	3.5	46	1.4	710	<4	1.3	<4	79	770	11	13	3400	92	25
154749															
154750	42	3.9	38	1.5	820	<4	1.4	<4	61	820	13	6	4600	100	18
154751	38	3.4	34	1.3	520	<4	1.1	<4	68	890	12	6	3200	93	13
154753	25	2.5	38	1.4	400	<4	0.81	5	29	1100	8	4	2300	62	16
154754	29	2.5	48	0.85	860	<4	0.87	8	24	1300	8	9	2800	66	20
154755	29	2.3	43	0.77	470	<4	0.93	8	27	980	8	13	2700	61	29
154757	22	2.1	36	0.67	600	<4	0.80	8	29	820	8	8	2700	55	24
154758	71	2.8	41	0.85	760	<4	0.83	10	25	1200	8	11	2900	69	18
154759	27	2.8	42	0.88	810	<4	0.81	7	30	1200	9	8	2900	68	19
154760	21	2.7	41	0.94	690	<4	0.81	7	21	910	8	11	3000	67	19
154762	22	2.6	39	0.97	670	<4	0.92	9	28	1000	8	12	2900	65	20
154763	23	2.7	44	1.0	680	<4	0.98	8	20	940	8	12	3000	71	20
154764	24	2.4	37	0.90	730	<4	0.83	10	27	1100	8	14	2800	68	20
154765	24	2.5	29	1.1	510	<4	0.80	14	41	790	8	8	2500	68	15
154767	16	2.5	29	0.56	360	<4	0.74	11	31	820	7	13	2400	58	13
154769	30	4.5	24	1.4	980	<4	1.6	<4	52	740	15	11	6000	120	15
154770	<2	<0.05	3	4.6	<4	<4	14.	<4	<2	<5	<1	<2	<10	<2	<1
154773	57	5.4	34	1.7	1200	<4	1.1	<4	52	930	19	12	4300	150	17
154775	35	3.8	32	1.3	760	<4	1.8	4	50	680	12	11	4400	100	14
154777	38	5.4	28	1.7	1200	<4	1.5	<4	49	690	19	12	5200	150	16
154779	33	3.4	34	1.2	690	<4	1.4	<4	49	970	10	11	3500	82	15
154780	20	3.3	31	1.3	610	<4	0.62	9	24	1500	10	13	3200	67	20
154781	27	3.0	42	0.77	650	<4	0.61	6	26	1300	10	13	2600	70	21
154785	18	2.0	26	0.59	330	<4	1.5	34	16	1000	6	14	2500	42	17
154787	12	2.1	24	0.68	520	<4	1.3	11	16	620	8	29	3200	52	24
154789	19	2.9	33	0.77	760	<4	1.1	9	22	770	9	22	3400	65	25
154792	16	2.7	20	0.60	550	<4	0.27	5	24	520	7	5	2600	45	28
154794	10	1.8	22	0.47	720	<4	0.82	11	12	650	5	16	2600	48	17
154795	21	2.2	30	0.60	630	<4	0.80	9	18	980	7	11	2700	59	22
154796	16	1.9	25	0.54	520	<4	1.1	8	14	730	6	4	2700	55	19
154798	14	4.3	15	0.61	800	<4	0.57	22	20	700	12	19	14000	67	32
154801	21	2.5	29	0.63	550	<4	0.80	7	25	990	8	9	2800	65	21
154802	14	2.3	25	0.52	460	<4	0.72	6	16	910	7	9	2800	59	17
154804	21	4.1	19	0.60	490	<4	0.62	13	23	700	12	10	4700	130	19
154805	22	2.4	29	0.69	620	<4	0.89	9	16	970	7	10	2800	60	19
154806	8	2.8	14	0.39	190	<4	0.23	8	16	1100	7	14	2700	49	11
154808	13	2.0	39	1.4	410	<4	1.3	13	12	980	6	22	2300	40	18
154812	12	2.3	20	0.69	590	<4	0.95	9	21	830	7	17	3200	58	22
154814	15	3.0	24	0.57	500	<4	0.42	7	22	1000	9	19	3100	63	21
154816	22	2.4	41	1.0	600	<4	0.81	8	18	900	7	13	2500	60	19
154818	6	0.78	14	0.65	130	<4	0.29	11	8	660	3	5	910	23	15
154820	15	2.4	26	1.2	480	<4	0.78	17	18	880	8	12	2600	59	17
154821	16	2.2	35	0.95	450	<4	0.57	8	17	830	7	5	1800	51	15
154825	9	2.6	32	0.48	380	<4	2.2	9	8	1500	5	42	3000	45	21

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
154729								0.1		1.4		6.8	
154730	91	52	1.8	190	53								
154731	39	38	0.78	180	27								
154732	64	52	1.2	180	39								
154735	93	41	1.6	160	56								
154736	85	63	1.7	170	80								
154738	82	59	1.7	160	91								
154740	100	64	1.8	160	76								
154742	82	41	1.4	160	47								
154744	110	59	1.5	180	50								
154747	90	34	1.3	160	51								
154749													
154750	94	46	1.6	180	47								
154751	89	33	1.7	140	42								
154753	82	53	1.7	160	51								
154754	120	90	1.7	220	65								
154755	80	69	1.7	190	73								
154757	70	68	1.9	200	63								
154758	97	80	2.1	200	72								
154759	98	81	2.1	210	63								
154760	80	82	1.9	190	71								
154762	82	89	1.9	210	63								
154763	85	88	2.0	200	69								
154764	82	85	1.9	200	75								
154765	74	38	1.6	150	58								
154767	63	41	1.6	150	60								
154769	81	18	1.1	180	37								
154770	6	<2	1.4	91	<10								
154773	100	28	1.3	170	41								
154775	78	26	1.2	190	46								
154777	92	18	1.1	150	39								
154779	75	29	1.6	160	49								
154780	69	43	2.1	140	89								
154781	89	56	1.8	140	76								
154785	92	35	1.4	140	85								
154787	57	48	1.8	170	110								
154789	76	62	1.9	170	95								
154792	52	23	1.4	48	47								
154794	62	91	1.4	150	67								
154795	89	100	1.6	160	64								
154796	68	95	1.7	190	54								
154798	62	19	1.2	87	120								
154801	67	84	2.0	170	63								
154802	57	71	2.3	170	58								
154804	77	28	1.8	120	62								
154805	78	85	1.5	180	64								
154806	42	14	2.6	160	83								
154808	57	42	1.5	420	94								
154812	59	59	1.3	160	110								
154814	55	47	2.3	170	87								
154816	97	81	1.5	190	66								
154818	34	27	0.39	260	24								
154820	59	26	1.0	270	62								
154821	60	42	1.3	240	53								
154825	77	21	1.8	240	220	7500							

TABLE B-III. Analyses of sediment samples

RAFT RIVER ~ SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
154827	40-42.173	-113.671	-3-12-	5.5	7.7	0.71	<2	7.4	<10	2400	3	3.0	8	41
154830	40-42.170	-113.691	-3-12-	4.1	5.8	0.71	<2	6.3	<10	910	2	1.5	9	58
154832	40-42.087	-113.696	-3-12-	3.8	5.4	0.71	<2	6.7	14	550	2	2.2	11	83
154834	40-42.163	-113.701	-3-12-	3.0	3.9	0.78	<2	5.6	15	810	3	0.85	8	49
154837	40-42.321	-113.503	-3-15-	2.9	4.9	0.60	<2	5.9	23	830	2	0.71	13	57
154838	40-42.317	-113.506	-3-15-	2.5	4.6	0.55	<2	6.9	28	870	2	0.77	10	66
154839	40-42.312	-113.515	-3-15-	2.7	4.2	0.64	<2	6.2	26	770	2	0.83	10	61
154840	40-42.310	-113.520	-3-12-	4.1	5.5	0.75	<2	5.4	24	710	2	0.86	8	51
154842	40-42.301	-113.529	-3-15-	3.2	4.6	0.69	<2	5.3	21	670	2	0.88	8	43
154843	40-42.297	-113.533	-3-15-	3.9	4.9	0.81	<2	5.9	20	680	2	0.84	8	59
154844	40-42.294	-113.545	-3-12-	48.	50.	0.96	<2	5.6	10	510	3	1.2	10	75
154849	40-42.109	-113.187	-3-15-	5.0	7.1	0.70	<2	4.3	16	700	2	0.40	5	36
154850	40-42.115	-113.170	-3-12-	8.5	9.3	0.91	<2	5.5	17	700	2	0.71	5	44
154851	40-42.112	-113.150	-3-15-	6.8	8.6	0.79	<2	5.2	21	720	2	0.64	10	44
154853	40-42.112	-113.151	-3-15-	3.6	4.1	0.88	<2	6.0	23	780	2	0.92	8	45
154856	40-41.949	-113.349	-3-12-	54.	52.	1.0	<2	5.8	19	680	2	1.0	10	46
154857	40-41.954	-113.356	-3-12-	48.	49.	0.97	<2	6.0	27	720	2	1.2	8	45
154861	40-42.196	-113.668	-3-12-	8.7	9.0	0.97	<2	5.8	28	580	2	0.82	11	42
154862	40-42.204	-113.642	-3-12-	13.	14.	0.93	<2	6.1	<10	750	2	2.3	15	34
154864	40-42.211	-113.629	-3-15-	6.3	8.1	0.78	<2	6.0	<10	820	2	1.8	10	30
154866	40-42.215	-113.627	-3-12-	3.7	5.7	0.65	<2	5.1	12	820	2	0.83	4	27
154868	40-42.223	-113.639	-3-12-	9.7	13.	0.73	<2	5.4	12	760	2	0.72	5	28
154870	40-42.105	-113.183	-3-12-	4.5	6.4	0.70	<2	5.2	21	760	2	0.66	7	46
154871	40-42.243	-113.606	-3-15-	4.3	4.4	0.98	<2	6.0	24	790	2	0.91	8	66
154872	40-42.251	-113.607	-3-15-	7.8	7.3	1.1	<2	5.8	23	760	2	0.93	9	75
154873	40-42.247	-113.632	-3-15-	2.5	2.9	0.86	<2	5.0	25	630	2	1.3	7	56
154874	40-42.248	-113.635	-3-15-	2.1	3.7	0.58	<2	5.1	29	630	2	1.4	7	53
154875	40-******	-*******	-3-15-	4.2	5.2	0.81	<2	5.3	22	720	2	0.92	7	48
154876	40-42.239	-113.636	-3-15-	27.	30.	0.89	<2	6.0	10	700	3	1.3	9	48
154877	40-******	-*******	-3-15-	5.3	5.7	0.93	<2	5.0	23	670	2	0.96	6	41
154879	40-41.695	-113.736	-3-15-	4.5	4.4	1.0	<2	7.8	<10	540	4	1.6	19	230
154880	40-41.724	-113.695	-3-12-	23.	20.	1.2	<2	7.5	<10	610	2	1.8	6	55
154882	40-41.715	-113.691	-3-15-	4.6	5.8	0.79	<2	8.7	<10	610	2	1.8	6	25
154883	40-42.051	-113.691	-3-15-	1.1	3.9	0.29	<2	7.8	<10	910	2	1.6	<4	20
154885	40-42.055	-113.670	-3-15-	2.5	3.4	0.72	<2	5.3	21	800	2	1.2	6	35
154886	40-42.066	-113.669	-3-15-	2.5	3.5	0.70	<2	5.5	19	790	2	1.3	6	33
154892	40-42.211	-113.681	-3-12-	6.8	8.3	0.81	<2	5.4	16	830	2	0.96	6	35
154894	40-42.112	-113.762	-3-12-	3.6	3.7	0.98	<2	7.1	<10	670	3	2.4	12	82
154895	40-42.097	-113.763	-3-15-	3.3	4.7	0.71	<2	5.9	19	860	2	0.87	7	41
154896	40-42.080	-113.757	-3-15-	5.3	6.6	0.81	<2	5.6	19	770	2	1.3	5	33
154897	40-42.061	-113.762	-3-15-	2.9	5.6	0.51	<2	5.5	15	760	2	1.0	6	30
154898	40-42.039	-113.761	-3-15-	2.7	5.3	0.52	<2	5.9	17	860	2	1.1	7	51
154899	40-42.028	-113.737	-3-15-	3.5	5.9	0.59	<2	7.0	14	770	3	1.2	10	87
154900	40-42.028	-113.722	-3-15-	3.0	3.5	0.86	<2	6.6	20	870	2	1.2	6	47
154901	40-42.043	-113.692	-3-15-	2.1	4.3	0.50	<2	7.2	<10	770	3	1.5	5	28
154904	40-42.055	-113.652	-3-15-	2.0	3.5	0.59	<2	5.5	18	690	2	1.2	7	35
154905	40-42.027	-113.672	-3-15-	2.4	3.6	0.66	<2	5.3	18	690	2	1.0	7	41
154906	40-42.009	-113.684	-3-15-	2.8	3.2	0.87	<2	6.7	19	770	2	1.1	8	40
154907	40-41.781	-113.818	-3-12-	12.	13.	0.91	<2	6.3	13	690	2	1.6	7	64
154909	40-41.780	-113.816	-3-15-	31.	36.	0.85	<2	6.0	18	710	2	1.3	8	58
154910	40-41.657	-113.774	-3-15-	2.5	3.3	0.76	<2	5.1	16	3000	2	1.9	5	63
154911	40-41.658	-113.760	-3-15-	28.	33.	0.85	<2	7.0	<10	580	4	1.1	6	30
154912	40-41.659	-113.755	-3-12-	56.	64.	0.88	<2	6.8	<10	540	4	1.2	4	20
154914	40-41.659	-113.750	-3-12-	19.	26.	0.75	<2	7.1	<10	590	3	1.6	5	26
154916	40-41.659	-113.750	-3-12-	32.	34.	0.94	<2	6.7	<10	810	2	1.4	7	35

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
154827	16	3.6	41	1.2	650	<4	1.7	15	31	5200	12	19	4100	68	58
154830	19	4.2	32	1.0	910	<4	1.2	18	29	1600	11	22	7700	83	31
154832	31	5.0	39	1.6	1100	<4	1.3	31	40	1900	17	14	9800	120	41
154834	15	2.7	27	0.59	850	<4	0.85	13	18	750	8	13	3900	62	29
154837	19	3.6	28	0.59	760	<4	0.55	7	24	1000	9	12	3400	78	21
154838	20	3.2	32	0.70	800	<4	0.61	7	25	1100	11	12	3400	77	22
154839	23	2.6	35	0.67	670	<4	0.76	8	24	830	9	9	3200	73	22
154840	25	2.1	30	0.55	490	<4	0.70	7	21	880	8	13	2600	59	29
154842	21	2.2	31	0.58	550	<4	0.81	7	20	660	7	10	2800	61	23
154843	27	2.7	33	0.72	460	<4	0.77	7	24	750	9	13	3000	71	24
154844	21	3.0	25	0.50	700	<4	1.2	6	30	670	12	11	4800	88	23
154849	10	1.8	16	0.32	430	<4	0.35	5	16	640	6	10	2200	41	25
154850	18	1.8	27	0.48	310	<4	0.69	9	18	650	8	17	2800	57	33
154851	27	2.6	26	0.53	740	<4	0.64	6	23	1000	7	10	2900	53	23
154853	23	2.4	38	0.62	660	<4	1.0	8	20	920	8	3	3100	65	23
154856	26	2.8	42	0.73	770	<4	0.83	8	24	1100	9	21	2600	60	26
154857	25	2.5	46	0.73	500	<4	0.83	8	23	980	9	17	2800	61	32
154861	87	2.9	53	0.75	640	<4	0.85	7	20	2100	9	11	2600	66	32
154862	17	4.2	27	1.1	850	<4	1.4	4	22	1100	14	22	4400	120	31
154864	8	3.4	20	0.85	580	<4	1.5	8	14	620	12	34	4300	95	25
154866	12	1.4	21	0.35	340	<4	1.3	8	14	550	5	17	2000	35	22
154868	11	1.6	19	0.38	380	<4	1.3	8	16	610	6	32	1900	36	30
154870	16	2.0	26	0.45	580	<4	0.65	7	23	760	7	10	2700	48	30
154871	22	2.7	35	0.68	620	<4	0.78	7	21	1100	8	3	2800	67	23
154872	18	2.7	32	0.65	640	<4	0.87	9	19	930	8	11	3000	66	22
154873	19	2.3	29	0.73	540	<4	0.67	7	21	870	7	15	2400	58	22
154874	23	2.2	31	0.73	550	<4	0.69	6	23	1200	7	8	2200	55	25
154875	22	2.4	29	0.65	570	<4	0.78	8	17	940	7	8	2500	58	21
154876	20	2.9	31	0.71	640	<4	1.3	12	19	990	9	36	3100	65	34
154877	17	2.3	29	0.56	450	<4	0.74	6	15	930	6	6	2600	58	20
154879	50	4.4	64	1.7	860	<4	1.5	<4	73	800	12	13	3700	100	13
154880	13	2.6	26	0.77	550	<4	2.2	6	19	490	8	34	2700	48	19
154882	21	2.6	24	0.64	440	<4	2.5	10	12	490	9	38	2700	46	21
154883	11	2.1	29	0.42	450	<4	2.4	11	7	550	5	10	2200	35	18
154885	24	2.0	30	0.60	760	<4	0.98	7	14	710	6	6	2500	53	17
154886	29	2.2	34	0.68	670	<4	0.90	8	16	890	7	17	2300	52	17
154892	15	2.0	36	0.54	490	<4	0.81	9	12	820	7	15	2500	53	20
154894	25	4.5	44	1.5	970	<4	1.6	28	30	1100	12	12	6200	100	23
154895	20	2.6	28	0.54	590	<4	0.69	10	19	920	8	15	3200	59	30
154896	14	2.0	29	0.57	440	<4	1.0	9	13	870	7	17	2700	48	23
154897	18	1.9	30	0.51	810	<4	1.0	9	12	640	6	12	2600	46	19
154898	17	2.3	31	0.59	630	<4	1.1	13	17	630	7	18	3100	57	24
154899	28	3.5	49	0.96	650	<4	1.6	12	32	670	10	16	3500	71	24
154900	20	2.6	36	0.74	640	<4	1.3	13	16	710	7	12	2900	57	25
154901	16	2.4	34	0.54	560	<4	2.0	12	11	770	6	10	2500	45	21
154904	19	2.1	27	0.63	550	<4	0.83	9	15	670	6	19	2700	52	21
154905	20	2.2	28	0.68	600	<4	0.93	10	17	710	7	17	2600	52	20
154906	23	2.7	35	0.60	690	<4	0.99	9	18	680	8	11	2800	59	22
154907	20	2.8	37	0.56	510	<4	0.97	9	25	1600	8	10	3700	79	23
154909	28	4.0	37	0.50	270	<4	0.65	7	27	2300	8	14	2700	80	25
154910	39	2.7	27	1.1	590	<4	0.43	<4	38	1200	7	6	1900	140	14
154911	33	2.7	57	0.63	630	<4	1.8	33	14	780	8	32	2800	52	32
154912	39	2.1	52	0.47	520	<4	2.2	25	9	780	6	31	1900	37	28
154914	25	2.1	42	0.54	390	<4	2.4	23	11	820	6	30	2100	42	25
154916	25	2.4	38	0.63	490	<4	1.9	8	17	770	7	22	2400	61	17

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
154827	100	25	1.7	870	260	6900							
154830	98	31	1.5	240	160	7200							
154832	110	23	1.5	190	130	3600							
154834	53	34	2.2	140	100	3300							
154837	69	67	2.5	180	66	7200							
154838	80	69	2.8	190	65	5400							
154839	89	93	2.1	170	70	3600							
154840	69	81	1.8	160	66	3000							
154842	69	89	1.6	150	68	2700							
154843	82	84	1.7	150	68	3300							
154844	78	42	1.4	140	64	3900							
154849	34	31	2.3	150	64								
154850	46	78	1.6	150	92								
154851	60	45	2.2	160	65								
154853	85	100	1.9	170	62								
154856	70	46	1.8	160	96								
154857	65	64	2.1	150	86								
154861	170	89	1.4	140	62								
154862	77	28	1.5	180	92								
154864	62	21	1.7	160	160								
154866	53	49	1.7	150	100								
154868	71	29	2.0	140	120								
154870	55	53	2.2	160	72								
154871	82	84	1.9	170	61								
154872	69	92	1.9	180	73								
154873	88	85	1.6	140	64								
154874	110	83	1.5	160	60								
154875	74	74	1.7	160	69								
154876	80	53	1.8	160	110								
154877	65	84	1.5	160	62								
154879	110	39	1.5	120	47								
154880	69	19	1.6	130	61								
154882	74	18	1.7	140	98								
154883	67	38	1.6	280	88								
154885	84	71	1.7	210	61								
154886	130	68	1.4	190	64								
154892	61	60	1.5	170	80								
154894	87	26	1.6	250	81								
154895	80	73	2.4	210	96								
154896	64	67	1.6	200	96								
154897	79	87	1.7	180	78								
154898	70	100	1.8	210	100								
154899	93	89	2.1	190	87								
154900	80	130	1.9	210	83								
154901	80	56	1.6	250	85								
154904	67	76	1.6	160	78								
154905	68	81	1.6	190	83								
154906	83	100	1.8	170	67								
154907	83	63	1.6	180	66								
154909	100	69	1.5	160	64								
154910	180	38	1.5	200	40								
154911	96	40	1.6	140	130								
154912	89	33	1.5	140	110								
154914	73	17	1.4	140	98								
154916	78	27	1.7	150	72								

TABLE B-III. Analyses of sediment samples

5-c

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CD (PPM)	CR (PPM)
154920	40	-41.654	-113.739	-3-15-	4.1	6.4	0.63	<2	7.4	<10	820	3	1.4	6	38
154922	40	-41.649	-113.739	-3-15-	6.1	7.1	0.86	<2	7.4	12	920	2	1.4	9	63
154923	40	-41.652	-113.717	-3-15-	6.4	10.	0.63	<2	7.7	<10	640	1	1.5	<4	14
154924	40	-41.628	-113.716	-3-15-	9.8	13.	0.77	<2	8.8	<10	780	2	1.5	<4	15
154925	40	-42.296	-113.592	-3-15-	2.9	5.1	0.56	<2	6.0	21	650	2	0.25	5	45
154928	40	-42.250	-113.624	-3-15-	2.9	3.4	0.86	<2	5.1	26	550	2	0.86	5	58
154930	40	-42.283	-113.616	-3-12-	13.	14.	0.90	<2	5.9	<10	630	3	1.0	7	52
156363	40	-42.269	-113.712	-3-15-	2.4	3.2	0.76	<2	5.1	19	700	2	0.89	6	83
156364	40	-42.236	-113.700	-3-12-	3.5	4.6	0.76	<2	5.6	16	740	3	0.76	9	76
156365	40	-42.219	-113.673	-3-12-	4.2	5.9	0.72	<2	6.3	17	970	3	0.84	6	45
156366	40	-42.223	-113.704	-3-15-	3.1	3.7	0.83	<2	5.8	18	850	2	0.77	10	53
156367	40	-42.231	-113.711	-3-15-	3.2	3.6	0.89	<2	6.3	20	750	2	0.73	7	41
156368	40	-42.252	-113.683	-3-12-	3.9	4.8	0.81	<2	5.9	16	700	2	0.81	10	63
156369	40	-42.255	-113.711	-3-12-	6.7	6.3	1.1	<2	5.6	22	640	2	1.4	11	59
156370	40	-42.264	-113.696	-3-15-	2.4	3.0	0.79	<2	5.0	29	650	2	0.97	7	49
156371	40	-42.277	-113.696	-3-15-	3.4	3.1	1.1	<2	5.0	26	700	2	0.77	6	47
156372	40	-42.266	-113.677	-3-12-	2.7	3.0	0.91	<2	4.5	16	590	1	1.6	6	55
156373	40	-41.989	-113.867	-3-12-	10.	12.	0.90	<2	5.7	16	710	2	1.3	5	33
156374	40	-41.985	-113.884	-3-12-	4.5	4.2	1.1	<2	5.0	24	790	2	2.4	<4	35
156375	40	-41.959	-113.861	-3-12-	2.5	3.2	0.79	<2	4.1	22	520	1	4.3	<4	70
156376	40	-41.964	-113.837	-3-15-	4.2	7.6	0.56	<2	6.9	15	830	2	0.70	8	52
156377	40	-41.975	-113.852	-3-15-	3.4	4.0	0.85	<2	6.8	18	720	3	0.94	6	68
156378	40	-41.969	-113.870	-3-12-	3.1	3.1	1.0	2	4.1	29	510	1	4.6	4	52
156379	40	-42.371	-113.590	-3-12-	6.3	7.8	0.80	<2	5.0	17	720	2	0.59	<4	70
156380	40	-42.285	-113.629	-3-12-	4.8	5.9	0.81	<2	5.2	19	690	2	0.74	7	39
156381	40	-42.285	-113.627	-3-15-	6.2	6.1	1.0	<2	<0.05	<10	<2	<1	<0.05	<4	<1
156382	40	-42.275	-113.612	-3-15-	16.	15.	1.1	<2	6.2	<10	710	3	0.97	10	62
156383	40	-42.232	-113.599	-3-12-	12.	12.	0.99	<2	5.6	10	770	2	1.1	6	36
156384	40	-42.232	-113.620	-3-12-	4.5	6.4	0.71	<2	5.5	19	790	2	0.74	5	54
156385	40	-42.215	-113.601	-3-15-	3.3	4.5	0.74	<2	6.1	24	760	2	0.79	9	48
155386	40	-42.213	-113.578	-3-15-	3.3	4.3	0.76	<2	5.5	20	740	2	0.84	7	45
156387	40	-42.208	-113.574	-3-15-	3.3	3.9	0.86	<2	5.5	17	760	2	0.93	9	41
156388	40	-42.177	-113.598	-3-15-	4.2	5.7	0.73	<2	5.6	14	870	2	0.88	8	30
156389	40	-42.178	-113.617	-3-12-	9.1	12.	0.74	<2	6.5	<10	960	2	1.3	5	35
156391	40	-42.190	-113.579	-3-15-	3.8	4.8	0.79	<2	6.2	22	750	2	0.81	6	42
156392	40	-42.200	-113.573	-3-15-	3.0	4.0	0.75	<2	5.0	18	700	2	0.82	7	35
156393	40	-42.145	-113.608	-3-12-	5.0	10.	0.49	<2	6.2	<10	1100	2	1.8	<4	19
156394	40	-42.151	-113.628	-3-15-	3.8	5.6	0.67	<2	7.2	<10	1200	3	1.8	5	19
156395	40	-42.149	-113.632	-3-12-	3.3	6.5	0.50	<2	7.5	<10	1000	3	1.6	4	18
156396	40	-42.144	-113.676	-3-15-	4.4	9.3	0.48	<2	7.9	<10	1000	3	1.7	4	25
156397	40	-42.146	-113.663	-3-12-	4.5	6.6	0.69	<2	6.8	<10	960	3	1.5	8	46
156398	40	-42.157	-113.674	-3-12-	7.0	8.4	0.83	<2	6.5	<10	910	2	1.7	7	49
156399	40	-42.157	-113.663	-3-12-	6.8	11.	0.64	<2	7.1	<10	950	3	2.1	8	29
156400	40	-42.109	-113.685	-3-12-	6.2	13.	0.48	<2	7.6	<10	880	3	2.0	<4	19
156402	40	-42.120	-113.716	-3-15-	3.2	5.6	0.56	<2	6.9	<10	970	2	1.9	7	26
156403	40	-42.112	-113.704	-3-15-	10.	9.0	1.1	<2	7.9	<10	960	3	2.0	4	31
156404	40	-42.111	-113.713	-3-12-	6.8	14.	0.49	<2	8.2	<10	700	3	2.1	6	18
156406	40	-42.147	-113.735	-3-12-	4.1	5.1	0.80	<2	6.7	17	800	3	0.90	7	47
156410	40	-42.134	-113.776	-3-15-	2.9	3.5	0.82	<2	5.0	25	600	2	3.8	6	36
156417	40	-42.083	-113.710	-3-15-	2.4	2.7	0.90	<2	6.7	21	790	2	2.0	5	32
156418	40	-42.081	-113.694	-3-15-	2.3	3.2	0.72	<2	8.6	10	940	3	1.8	4	16
156419	40	-42.075	-113.698	-3-12-	3.9	6.0	0.65	<2	7.1	13	800	2	1.5	4	28
156421	40	-42.049	-113.712	-3-15-	3.1	3.6	0.88	<2	8.1	10	940	2	1.4	6	26
156422	40	-42.046	-113.731	-3-15-	1.4	3.0	0.47	<2	9.6	<10	890	3	2.5	<4	13
156423	40	-42.027	-113.716	-3-15-	2.8	3.4	0.83	<2	7.2	19	780	3	1.8	6	35

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

DR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
154920	21	2.1	44	0.57	440	<4	2.5	6	15	600	6	22	2100	44	13
154922	35	3.1	44	0.85	590	<4	1.6	6	32	970	8	20	2500	81	22
154923	8	1.2	23	0.27	230	<4	2.6	8	5	410	3	19	1400	16	11
154924	23	1.2	30	0.28	200	<4	3.2	6	7	300	3	17	1300	17	8
154925	13	2.9	28	0.55	330	<4	0.40	7	17	990	8	10	3200	60	13
154928	20	2.1	30	0.60	450	<4	0.61	6	25	630	7	11	2200	61	23
154930	15	2.4	26	0.70	440	<4	1.2	5	26	610	8	11	3100	59	20
156363	21	2.0	33	0.57	630	<4	0.92	7	23	900	6	13	2600	56	19
156364	22	2.8	33	0.66	810	<4	0.62	10	33	980	9	14	3600	74	52
156365	17	2.3	44	0.58	440	<4	1.0	9	17	820	7	18	2900	57	35
156366	19	2.4	41	0.60	1000	<4	0.75	8	20	960	7	9	2800	68	22
156367	18	2.4	38	0.66	730	<4	0.86	11	22	880	8	11	2900	62	27
156368	18	2.7	33	0.60	510	<4	0.55	7	32	900	10	13	3600	81	46
156369	25	2.8	41	0.66	700	<4	0.65	7	36	1000	9	12	3000	72	27
156370	22	2.1	38	0.59	700	<4	0.61	6	20	1200	7	8	2400	55	26
156371	25	2.1	39	0.66	770	<4	0.64	6	21	1500	7	9	2300	55	21
156372	19	1.9	33	0.54	420	<4	0.54	5	30	810	6	7	2100	76	20
156373	15	2.0	30	0.63	560	<4	1.2	11	14	860	6	14	2200	45	20
156374	13	1.8	27	0.51	350	<4	0.99	15	11	870	5	11	2500	40	22
156375	12	1.6	28	1.3	640	<4	0.51	8	20	1000	4	9	1700	50	19
156376	23	2.9	43	0.86	930	<4	1.0	13	22	830	7	26	3400	64	20
156377	18	2.7	40	1.0	880	<4	0.76	12	21	1300	7	15	2500	60	30
156378	16	1.8	31	0.83	580	<4	0.55	10	27	1200	5	9	1800	58	20
156379	8	1.6	17	0.38	290	<4	0.55	6	12	530	6	10	2600	43	19
156380	13	2.2	27	0.49	400	<4	0.62	9	18	870	7	10	3200	53	24
156381	<2	<0.05	2	<0.05	<4	<4	<0.05	<4	<2	13	<1	<2	<10	<2	<1
156382	24	2.8	34	0.76	570	<4	1.0	9	33	720	9	15	3500	70	27
156383	13	2.1	24	0.55	520	<4	1.1	8	18	690	7	19	2800	55	29
156384	10	1.9	24	0.40	730	<4	0.74	12	13	650	6	15	2900	50	30
156385	21	2.5	32	0.59	700	<4	0.72	9	16	900	8	15	2900	63	19
156386	19	2.3	24	0.56	560	<4	0.83	10	18	790	7	12	3000	60	20
156387	17	2.4	27	0.61	600	<4	0.79	8	16	880	7	14	2800	60	20
156388	15	2.1	26	0.47	620	<4	1.0	10	14	650	6	21	2600	53	23
156389	11	2.5	25	0.61	420	<4	1.6	10	15	1000	8	27	3300	54	26
156391	18	2.4	29	0.58	400	<4	0.78	8	17	610	7	14	2700	58	25
156392	16	2.0	29	0.52	580	<4	0.86	7	14	630	6	7	2600	54	18
156393	5	2.4	16	0.40	380	<4	1.7	18	7	2300	7	53	4100	44	34
156394	8	2.5	23	0.55	340	<4	2.1	13	8	1300	7	31	3300	51	21
156395	7	2.7	29	0.50	390	<4	2.4	18	10	1400	6	32	3800	43	19
156396	9	2.8	33	0.46	540	<4	2.3	15	10	780	6	28	3100	48	28
156397	15	3.5	29	0.85	780	<4	1.5	16	22	1200	10	23	5800	73	27
156398	14	3.8	30	0.88	920	<4	1.3	18	22	1700	11	39	7600	77	33
156399	11	3.6	24	0.79	570	<4	1.9	16	16	1400	10	35	5200	77	26
156400	6	2.3	22	0.41	490	<4	3.1	17	7	870	5	45	3000	41	26
156402	15	2.4	35	0.61	880	<4	2.2	12	11	1000	6	22	2500	46	21
156403	9	2.9	26	0.58	520	<4	2.4	21	11	1000	6	26	3600	52	23
156404	9	3.5	22	0.61	710	<4	2.9	16	11	810	8	26	3900	85	26
156406	19	2.9	39	0.68	730	<4	0.83	11	21	530	9	16	3900	70	45
156410	15	2.3	27	0.72	460	<4	0.75	10	15	610	6	11	3400	56	18
156417	12	2.3	33	0.77	390	<4	1.6	10	15	750	6	10	2500	50	16
156418	13	2.1	41	0.53	610	<4	2.5	12	8	750	5	14	2100	31	14
156419	10	1.9	32	0.49	490	<4	2.2	19	10	760	5	19	2400	41	22
156421	17	3.2	52	0.77	640	<4	1.7	17	12	640	8	11	3400	56	20
156422	6	1.5	20	0.36	290	<4	3.3	7	6	950	4	17	1500	28	21
156423	16	2.4	35	0.72	480	<4	1.5	10	17	580	7	17	2700	54	20

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
154920	67	24	1.6	150	76								
154922	120	36	1.7	140	73								
154923	39	10	1.6	140	45								
154924	47	7	2.0	160	49								
154925	56	55	2.6	120	70								
154928	85	79	1.5	110	53								
154930	55	34	1.6	120	60								
156363	82	89	1.8	170	56								
156364	87	78	1.7	150	91								
156365	75	73	1.8	180	90								
156366	94	74	1.5	140	59								
156367	85	100	1.6	140	88								
156368	66	55	1.8	170	110								
156369	110	64	1.2	180	68								
156370	110	80	1.5	120	56								
156371	140	73	1.6	120	50								
156372	120	50	1.2	110	48								
156373	73	76	1.7	160	77								
156374	78	100	1.6	170	66								
156375	100	57	1.1	140	45								
156376	130	85	1.8	130	120								
156377	120	120	2.0	130	73								
156378	150	68	1.0	170	43								
156379	32	50	2.2	160	65								
156380	54	46	2.0	160	73								
156381	<2	<2	0.44	<1	<10								
156382	75	71	1.6	150	78								
156383	52	57	1.6	170	98								
156384	50	72	2.1	140	83								
156385	74	81	1.9	150	75								
156386	65	96	1.7	170	77								
156387	61	82	2.0	170	73								
156388	54	88	1.7	150	110								
156389	54	27	2.0	160	140								
156391	63	95	1.6	150	75								
156392	61	79	1.7	160	67								
156393	40	21	2.0	210	240								
156394	56	21	2.3	230	140								
156395	63	30	2.0	240	140								
156396	72	45	1.6	340	160								
156397	71	32	1.8	230	140								
156398	73	30	1.6	230	150								
156399	75	27	1.6	250	170								
156400	47	18	1.7	270	210								
156402	51	27	1.4	300	120								
156403	58	24	1.5	280	140								
156404	63	14	1.7	200	99								
156406	72	87	1.5	160	96								
156410	59	72	1.4	180	65								
156417	63	66	1.9	200	70								
156418	88	35	1.7	270	60								
156419	65	64	1.7	240	120								
156421	110	64	1.9	240	68								
156422	44	14	1.4	360	130								
156423	71	88	1.8	200	74								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
156424	40-	42.023	-113.691	-3-15-	2.5	4.1	0.60	<2	6.4	16	700	2	3.0	6	41
156427	40-	42.063	-113.737	-3-12-	2.7	5.0	0.54	<2	6.2	<10	1100	2	1.3	<4	26
156428	40-	42.079	-113.767	-3-15-	2.8	4.2	0.67	<2	6.9	13	830	2	2.0	7	42
156429	40-	42.111	-113.774	-3-12-	3.0	7.4	0.41	<2	6.7	<10	640	3	2.8	6	65
156430	40-	42.121	-113.770	-3-15-	2.7	4.0	0.68	<2	5.8	10	660	2	1.6	9	59
156431	40-	42.134	-113.754	-3-12-	2.6	4.6	0.56	<2	6.2	<10	620	2	2.2	9	59
156432	40-	42.148	-113.765	-3-12-	2.1	3.7	0.56	<2	6.0	<10	590	2	2.0	11	68
156433	40-	42.152	-113.782	-3-12-	2.8	6.3	0.44	<2	4.1	<10	400	2	2.5	<4	54
156434	40-	42.164	-113.785	-3-12-	3.2	6.6	0.49	<2	5.3	<10	610	2	2.1	<4	44
156435	40-	42.168	-113.772	-3-15-	3.1	4.0	0.78	<2	5.5	18	770	2	1.1	7	39
156436	40-	42.172	-113.766	-3-12-	3.0	5.2	0.59	<2	5.4	<10	660	2	1.5	6	43
156437	40-	42.231	-113.751	-3-12-	1.9	2.5	0.74	<2	3.0	<10	1100	1	12.	6	27
156438	40-	42.064	-113.770	-3-15-	3.7	7.8	0.48	<2	6.3	15	850	2	1.4	6	36
156439	40-	42.056	-113.784	-3-12-	3.1	10.	0.30	<2	7.5	<10	1300	3	1.7	<4	18
156440	40-	42.065	-113.802	-3-12-	1.5	5.7	0.26	<2	8.2	<10	1600	3	2.4	<4	12
156441	40-	42.044	-113.811	-3-12-	1.5	8.1	0.18	<2	7.4	<10	1500	3	1.8	<4	14
156442	40-	42.014	-113.777	-3-15-	3.0	8.4	0.36	<2	6.7	13	1100	3	1.6	4	27
155443	40-	42.004	-113.821	-3-15-	2.5	5.0	0.50	<2	5.3	10	710	2	2.0	5	33
156445	40-	42.061	-113.849	-3-15-	5.8	7.5	0.77	<2	6.9	11	1400	2	1.5	7	28
156446	40-	42.070	-113.852	-3-12-	3.2	4.2	0.76	<2	5.7	<10	1000	2	1.1	4	25
156447	40-	42.093	-113.871	-3-15-	5.0	5.2	0.97	<2	6.3	14	800	2	0.98	5	39
156448	40-	42.110	-113.877	-3-12-	1.6	5.0	0.31	<2	6.1	<10	1100	2	3.9	<4	21
155450	40-	42.116	-113.855	-3-15-	3.9	5.7	0.68	<2	7.0	16	870	3	0.93	10	53
156451	40-	42.104	-113.864	-3-12-	1.2	4.3	0.27	<2	7.8	<10	1400	4	1.7	<4	16
156453	40-	42.109	-113.855	-3-12-	2.4	7.6	0.31	<2	6.0	<10	1000	2	2.0	4	38
156456	40-	42.195	-113.773	-3-15-	2.8	3.2	0.87	<2	5.7	<10	820	2	1.1	7	41
155457	40-	42.184	-113.768	-3-15-	2.7	3.7	0.73	<2	5.6	16	780	2	1.0	7	40
156458	40-	42.184	-113.727	-3-15-	2.6	2.9	0.89	<2	6.6	<10	620	2	3.6	17	69
156459	40-	42.205	-113.739	-3-15-	7.0	8.0	0.88	<2	6.0	11	690	2	1.8	9	52
155460	40-	42.204	-113.722	-3-12-	3.6	4.1	0.87	<2	6.5	<10	900	2	1.5	8	65
156462	40-	42.214	-113.715	-3-12-	3.5	4.0	0.86	<2	6.4	<10	770	2	1.8	8	52
156464	40-	42.222	-113.731	-3-15-	2.2	2.4	0.90	<2	4.8	14	690	2	5.0	7	44
156465	40-	42.227	-113.741	-3-15-	1.9	2.8	0.69	<2	5.3	11	660	2	3.8	8	51
156466	40-	******	-*******	-3- -	2.5	4.2	0.59	<2	5.6	<10	690	2	2.3	9	54
156467	40-	******	-*******	-3- -	0.51			<2	24	<4	17	<1	19.	<2	<4
156469	40-	41.872	-113.576	-3-12-	2.6	3.0	0.85	<2	5.8	<10	630	1	1.4	5	56
156470	40-	41.879	-113.552	-3-12-	2.3	2.9	0.78	<2	4.6	<10	510	2	0.47	6	40
156473	40-	41.885	-113.537	-3-12-	2.1	3.4	0.61	<2	5.3	<10	570	3	0.42	9	49
156482	40-	42.467	-113.636	-3-15-	3.3	3.1	1.1	<2	4.8	<10	930	2	17.	7	46
156483	40-	42.411	-113.659	-3-15-	0.99	0.90	1.1	<2	1.6	<10	210	1	6.9	4	21
156485	40-	42.397	-113.666	-3-12-	1.7	2.6	0.66	<2	3.8	<10	320	1	0.26	4	40
156487	40-	42.379	-113.692	-3-15-	1.0	1.1	0.94	<2	1.6	<10	180	1	0.14	<4	22
156498	40-	42.377	-113.689	-3-15-	1.3	1.7	0.78	<2	2.6	<10	230	1	0.20	<4	30
156494	40-	42.361	-113.720	-3-15-	3.6	4.2	0.85	<2	5.7	23	830	2	0.93	8	50
156504	40-	42.236	-113.591	-3- -	3.6	4.5	0.79	<2	5.2	21	770	2	0.86	8	41
156517	40-	42.067	-113.659	-3-15-	3.4	4.0	0.86	<2	5.7	22	800	2	1.2	6	42
155518	40-	42.061	-113.661	-3-15-	8.5	8.9	0.95	<2	6.6	34	640	3	1.1	7	59
156519	40-	42.077	-113.644	-3-15-	2.3	3.2	0.72	<2	7.5	19	940	2	3.2	6	34
156520	40-	42.041	-113.660	-3-15-	2.8	3.6	0.78	<2	5.5	24	730	2	4.1	6	42
155521	40-	42.061	-113.737	-3-15-	3.1	4.7	0.67	<2	8.2	15	1100	3	1.7	4	24
156523	40-	42.101	-113.632	-3-12-	6.2	9.0	0.69	<2	6.8	10	920	2	1.7	5	38
156524	40-	42.287	-113.666	-3- -	2.7	4.0	0.68	<2	3.8	13	450	1	0.38	6	38
156525	40-	42.281	-113.659	-3-12-	3.4	4.5	0.76	<2	6.0	10	580	2	0.51	10	63
156526	40-	42.291	-113.674	-3-12-	5.3	6.9	0.76	<2	6.6	15	680	2	0.53	12	64
156527	40-	42.305	-113.669	-3-15-	3.6	4.8	0.75	<2	7.0	19	700	2	0.47	9	74

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
156424	19	2.3	35	0.88	480	<4	1.4	10	16	720	7	19	2700	50	18
156427	7	1.5	25	0.36	430	<4	1.7	7	7	760	5	13	2200	35	20
156428	17	2.6	40	0.85	470	<4	0.99	9	19	620	8	12	3000	60	28
156429	13	4.3	30	1.2	1100	<4	1.8	40	21	2000	12	13	11000	99	41
156430	21	2.8	29	0.85	730	<4	1.1	16	23	740	9	18	4600	72	23
156431	20	3.7	31	1.8	860	<4	0.85	17	28	1200	11	9	6100	78	33
156432	15	4.2	23	1.2	2100	<4	1.1	21	29	900	12	14	9100	92	21
156433	4	2.9	14	1.1	1000	<4	0.90	26	14	850	9	17	11000	68	23
156434	7	2.9	20	0.85	940	<4	1.1	23	13	1600	10	24	8800	66	39
156435	18	2.2	27	0.65	500	<4	1.0	9	15	740	7	16	3100	53	25
156436	11	2.6	20	0.85	590	<4	1.0	18	17	1300	8	17	4400	58	29
156437	8	2.5	19	3.5	470	<4	0.51	5	16	1100	4	2	1300	32	16
156438	16	2.2	32	0.62	560	<4	1.2	11	14	650	7	15	2900	51	26
156439	9	1.7	25	0.45	520	<4	1.9	14	16	590	4	8	2900	34	20
156440	4	1.3	21	0.49	220	<4	2.5	10	7	690	4	13	1700	21	19
156441	6	1.5	29	0.62	530	<4	2.1	13	8	720	4	7	2100	28	18
156442	12	1.8	31	0.67	510	<4	1.7	24	12	710	5	13	2700	38	24
156443	11	1.9	25	0.55	430	<4	1.1	13	14	470	5	13	2500	47	20
156445	13	2.8	33	0.56	2200	<4	1.3	9	11	1000	7	15	2100	44	39
156446	11	1.7	29	0.66	650	<4	1.1	12	11	550	5	8	2100	36	27
156447	19	2.5	33	0.63	540	<4	0.81	10	16	570	7	9	2700	53	32
156448	7	1.6	29	0.69	350	<4	1.7	13	7	760	4	15	2100	28	15
156450	26	3.2	47	0.76	730	<4	0.86	10	23	780	9	9	3200	70	23
156451	5	1.4	33	0.41	330	<4	2.5	11	5	530	3	10	1500	20	12
156453	9	2.1	27	0.83	500	<4	1.4	13	13	750	6	15	2900	39	18
156456	15	2.4	30	0.66	530	<4	1.1	10	16	570	6	9	2900	58	19
156457	22	2.3	31	0.65	480	<4	1.1	10	14	600	7	16	3000	56	20
156458	32	6.3	36	1.8	1300	<4	1.2	31	30	2100	19	11	9800	180	31
156459	26	3.0	36	1.1	600	<4	0.79	11	24	1000	9	11	3300	67	24
156460	14	3.7	21	1.0	730	<4	1.8	22	19	950	10	21	5700	88	22
155462	14	3.4	22	1.0	740	<4	1.6	20	20	1100	9	20	5200	81	24
156464	21	2.5	32	2.7	870	<4	0.65	8	18	1900	7	9	2400	55	19
156465	20	3.1	32	2.1	590	<4	0.77	11	21	1300	8	14	3600	64	21
156466	9	4.1	15	1.0	690	<4	0.66	18	17	1700	11	15	5500	89	38
156467	<2	<10	3	4.7	<2	<4	5.5	<4	<4	<40	<1	<5	<2	<4	<1
156469	8	1.9	43	0.75	160	<4	0.37	<4	14	300	9	12	1900	62	17
156470	21	2.5	30	0.57	520	<4	0.52	13	16	680	7	11	2100	51	13
156473	19	3.2	19	0.64	520	<4	0.80	28	20	790	9	10	2900	69	13
156482	15	2.1	33	0.99	350	<4	0.29	5	21	480	8	8	1400	97	20
156483	13	1.2	9	3.0	260	<4	0.15	<4	7	320	2	3	730	22	7
156485	9	2.0	10	0.51	290	<4	0.40	4	14	300	6	5	3200	40	13
156487	5	0.70	7	0.28	100	<4	0.13	<4	4	160	2	4	730	18	5
156488	9	1.4	11	0.49	200	<4	0.19	<4	12	310	4	4	1400	25	10
156494	23	2.5	32	0.65	620	<4	0.61	8	19	1200	9	15	2800	57	26
156504	18	2.3	27	0.55	540	<4	0.80	9	16	750	7	16	2600	58	20
155517	22	2.3	35	0.63	600	<4	1.0	8	16	870	7	12	2700	57	20
156518	34	2.5	44	0.72	370	<4	0.57	8	20	1100	10	20	3300	73	39
156519	14	2.2	39	0.86	760	<4	2.3	10	15	810	6	15	2400	44	17
156520	14	2.2	32	0.92	500	<4	0.98	9	17	800	7	10	2900	57	22
156521	16	2.0	35	0.49	510	<4	2.4	9	9	610	5	12	2300	40	19
155523	10	2.3	28	0.59	1300	<4	2.1	33	12	950	7	27	3800	48	31
156524	10	2.1	21	0.39	510	<4	0.42	6	17	430	6	9	4500	44	23
156525	15	3.7	31	0.71	760	<4	0.43	8	28	610	10	10	5800	70	30
156526	34	4.0	33	0.71	570	<4	0.58	8	37	710	11	11	5500	73	65
156527	24	4.2	37	0.69	710	<4	0.63	13	31	670	11	13	8100	89	18

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
156424	69	67	1.7	210	82								
156427	43	49	2.2	240	100								
156428	65	75	1.9	200	98								
156429	71	31	1.7	250	160								
156430	70	64	1.4	170	87								
156431	71	27	1.4	160	81								
156432	66	32	1.2	140	74								
156433	48	25	0.89	160	110								
156434	45	25	1.6	150	160								
156435	59	66	1.7	180	96								
156436	44	26	1.7	170	120								
156437	150	22	0.68	120	49								
156438	74	81	1.5	200	110								
156439	56	55	1.9	250	92								
156440	44	17	1.6	340	92								
156441	52	41	1.9	280	80								
156442	63	66	1.8	230	120								
156443	65	91	1.3	180	81								
156445	80	68	1.4	240	120								
156446	54	55	1.6	150	69								
156447	94	130	1.4	170	72								
156448	55	37	1.6	260	89								
156450	97	94	1.7	160	72								
156451	58	16	2.0	320	76								
156453	54	21	1.5	200	98								
156456	67	90	1.4	240	76								
156457	77	80	1.4	230	87								
156458	130	33	1.2	320	89								
156459	76	68	1.2	180	72								
156460	64	7	1.7	180	120								
156462	66	21	1.4	200	110								
156464	130	58	1.1	140	58								
156465	140	61	1.2	150	78								
156466	42	10	2.3	230	110								
156467	4	<2	2.3	59	<30								
156469	52	11	1.5	250	81	15							
156470	57	23	1.7	85	55	11							
156473	63	6	1.8	76	87								
156482	62	16	1.1	330	46	14							
156483	15	20	0.56	52	27	5							
156485	24	13	1.2	49	53	5							
156487	13	13	0.61	22	25	5							
156488	27	13	0.87	31	35	6							
156494	85	62	2.1	190	93								
156504	68	74	1.5	160	88								
156517	91	83	1.4	200	74								
156518	87	97	2.0	160	100								
156519	96	55	1.8	320	74								
156520	72	86	1.6	220	75								
156521	94	56	1.9	290	110								
156523	64	42	1.8	250	150								
156524	43	53	1.2	71	72								
156525	80	35	1.6	79	64								
156526	81	58	1.9	97	96								
156527	98	56	2.0	97	72								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L	TY	REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
156528	40	42.277	-113.659	-3	-12	-	3.3	4.4	0.74	<2	5.5	13	580	2	0.50	9	59
156529	40	42.290	-113.674	-3	-12	-	4.1	4.9	0.83	<2	6.8	18	700	3	0.51	12	63
156532	40	42.123	-113.729	-3	-15	-	9.6	12.	0.78	<2	7.2	<10	540	4	1.6	5	32
156535	40	42.155	-113.724	-3	-12	-	4.2	5.4	0.77	<2	6.4	<10	800	3	1.4	11	53
156537	40	42.187	-113.694	-3	-15	-	3.0	3.7	0.81	<2	7.7	<10	700	2	1.1	16	84
156538	40	42.172	-113.728	-3	-15	-	3.9	4.5	0.86	<2	7.3	15	730	2	1.4	13	110
156539	40	42.167	-113.731	-3	-15	-	3.2	4.2	0.77	<2	7.1	14	750	2	1.1	13	130
156540	40	42.161	-113.731	-3	-15	-	2.0	3.0	0.67	<2	6.1	<10	570	2	1.0	12	93
156541	40	42.135	-113.749	-3	-12	-	5.0	6.5	0.78	<2	6.6	11	680	3	1.6	11	57
156546	40	42.226	-113.656	-3	-12	-	2.5	5.0	0.50	<2	4.5	10	820	2	0.34	4	27
155549	40	42.235	-113.658	-3	-15	-	4.7	5.9	0.79	<2	5.7	22	800	3	1.0	8	40
156552	40	42.239	-113.670	-3	-12	-	6.0	7.9	0.75	<2	5.4	13	790	2	0.48	6	35
156554	40	42.239	-113.669	-3	-12	-	5.4	7.6	0.71	<2	5.5	17	860	2	0.48	5	37
156556	40	42.252	-113.655	-3	-12	-	4.8	7.0	0.69	<2	4.6	11	740	2	0.43	4	28
156557	40	42.250	-113.668	-3	-15	-	4.2	5.7	0.74	<2	5.6	14	770	3	0.72	9	42
156562	40	42.275	-113.662	-3	-15	-	3.2	4.2	0.76	<2	6.1	17	580	2	0.85	11	75
156564	40	42.282	-113.632	-3	-12	-	5.6	6.6	0.85	<2	5.0	14	710	2	1.0	11	37
156568	40	42.290	-113.646	-3	-12	-	4.0	4.2	0.94	<2	4.7	<10	580	2	0.76	7	34
156569	40	42.262	-113.630	-3	-12	-	2.1	3.8	0.56	<2	4.3	14	480	2	0.61	6	49
156573	40	42.101	-113.769	-3	-15	-	2.8	5.2	0.54	<2	7.0	14	940	3	1.2	7	62
156575	40	42.084	-113.754	-3	-12	-	2.0	5.3	0.38	<2	6.9	<10	980	2	1.9	4	32
156576	40	42.049	-113.755	-3	-12	-	2.8	5.2	0.54	12	6.4	37	950	3	1.3	6	45
156578	40	42.029	-113.747	-3	-15	-	2.6	4.1	0.64	12	6.6	38	780	3	1.1	8	42
156579	40	42.021	-113.754	-3	-15	-	3.1	4.6	0.67	<2	6.8	22	790	3	1.3	7	40
156580	40	41.997	-113.747	-3	-15	-	2.8	4.7	0.59	<2	7.3	14	770	2	2.9	6	40
156581	40	42.996	-113.725	-3	-15	-	2.8	3.8	0.74	<2	7.7	18	840	2	2.0	6	43
156583	40	41.998	-113.726	-3	-15	-	3.5	5.8	0.61	<2	7.0	25	730	2	2.8	6	38
156584	40	42.008	-113.697	-3	-15	-	2.9	3.7	0.78	<2	6.4	21	810	2	1.1	8	48
156586	40	41.986	-113.730	-3	-15	-	3.1	5.6	0.55	<2	8.2	<10	830	2	2.2	11	62
156587	40	41.982	-113.718	-3	-15	-	2.1	3.2	0.65	<2	7.0	24	740	2	1.7	8	64
156588	40	41.976	-113.744	-3	-15	-	2.7	22.	0.13	<2	5.1	<10	700	2	2.1	16	28
156589	40	41.956	-113.719	-3	-15	-	2.0	4.1	0.50	<2	5.6	24	800	2	2.1	7	40
155590	40	41.944	-113.669	-3	-15	-	2.1	3.3	0.65	<2	6.0	31	730	2	2.4	8	46
156591	40	41.941	-113.677	-3	-15	-	2.1	3.8	0.54	<2	6.7	22	760	3	1.2	10	59
155592	40	41.941	-113.662	-3	-15	-	2.9	5.9	0.49	<2	6.0	17	710	2	2.6	7	44
155593	40	41.918	-113.654	-3	-15	-	2.8	4.6	0.60	<2	6.7	20	790	3	1.1	9	63
156598	40	41.910	-113.636	-3	-15	-	2.3	3.8	0.59	<2	6.4	22	600	3	1.9	10	77
156603	40	41.892	-113.654	-3	-12	-	3.6	4.7	0.77	<2	5.8	11	810	3	0.80	7	41
156605	40	41.883	-113.662	-3	-15	-	4.0	4.7	0.85	<2	6.3	12	760	3	0.76	6	49
156609	40	41.861	-113.660	-3	-12	-	3.9	4.8	0.81	<2	5.0	18	630	2	1.1	7	38
156613	40	41.911	-113.561	-3	-12	-	5.0	5.4	0.93	<2	5.9	13	620	2	3.9	9	52
156614	40	41.906	-113.562	-3	-12	-	2.6	2.2	1.2	<2	3.1	<10	350	1	18.	6	36
156616	40	41.888	-113.548	-3	-12	-	3.6	5.4	0.66	<2	7.2	<10	760	4	0.99	9	59
156622	40	41.887	-113.524	-3	-12	-	9.2	15.	0.62	<2	6.1	<10	760	3	0.83	7	36
156624	40	41.891	-113.524	-3	-12	-	2.5	7.6	0.33	<2	7.6	<10	760	3	0.81	11	58
156628	40	41.895	-113.553	-3	-12	-	3.0	6.2	0.48	<2	7.1	<10	710	3	1.5	10	58
156630	40	41.909	-113.516	-3	-12	-	1.6	3.7	0.43	<2	6.5	13	670	2	1.6	10	55
156634	40	41.931	-113.536	-3	-12	-	2.3	3.5	0.65	<2	5.0	14	630	2	4.0	6	44
156635	40	41.922	-113.467	-3	-	-	3.1										
156636	40	41.922	-113.467	-3	-12	-	9.2	11.	0.84	<2	5.9	<10	460	5	0.93	<4	6
156637	40	41.917	-113.466	-3	-12	-	2.7	5.4	0.49	<2	7.6	10	900	3	0.89	10	54
156640	40	41.936	-113.516	-3	-12	-	2.4	4.9	0.49	<2	6.9	18	790	3	0.92	10	60
156644	40	41.926	-113.671	-3	-15	-	4.7	6.0	0.78	<2	7.9	10	850	5	1.0	7	43
156645	40	41.924	-113.687	-3	-15	-	3.6	6.1	0.58	<2	8.1	<10	830	6	1.2	6	38
156647	40	41.915	-113.693	-3	-15	-	3.4	4.8	0.71	<2	7.8	17	1000	3	0.94	9	60

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
156528	13	3.2	33	0.63	850	<4	0.44	8	25	550	9	7	5700	65	22
156529	24	3.2	39	0.73	570	<4	0.53	5	32	660	11	11	3100	74	41
156532	13	2.1	30	0.71	640	<4	2.3	25	12	890	6	32	2600	39	31
156535	18	4.0	38	0.67	1200	<4	1.0	23	25	850	11	19	7200	87	45
156537	36	5.5	45	1.6	1300	<4	1.5	22	39	2200	13	15	8900	130	24
156538	39	4.6	46	1.5	680	<4	1.2	7	47	1400	14	17	5400	100	26
156539	23	4.0	50	1.3	790	<4	1.1	12	40	790	13	11	5200	95	22
155540	22	4.3	34	1.4	780	<4	1.1	21	47	1300	11	6	6400	94	15
156541	37	3.8	44	1.2	1000	<4	0.88	14	38	1200	11	10	5300	78	37
156546	6	1.7	15	0.32	220	<4	0.38	4	9	610	5	7	2000	33	14
156549	27	2.7	38	0.69	770	<4	0.67	8	29	1400	8	11	2600	58	76
156552	9	2.0	20	0.40	530	<4	0.67	8	15	600	7	20	2700	46	25
156554	9	2.4	19	0.41	400	<4	0.46	7	15	700	7	11	2700	47	22
156556	7	1.5	15	0.32	350	<4	0.59	6	10	510	5	15	2300	36	20
156557	20	2.5	33	0.53	560	<4	0.64	8	20	820	8	12	2800	61	46
156562	22	3.3	52	0.52	590	<4	0.51	5	43	1400	10	14	2700	87	30
156564	18	2.5	30	0.48	1100	<4	0.61	7	21	970	7	16	2200	52	28
156568	17	2.0	29	0.38	550	<4	0.53	5	18	570	6	7	2200	52	28
156569	10	2.2	27	0.50	670	<4	0.36	8	18	640	6	9	3900	58	18
156573	21	3.0	33	0.70	470	<4	0.85	12	18	1300	9	19	3500	62	34
156575	7	1.8	19	0.54	370	<4	1.8	10	10	860	6	15	2900	48	22
156576	25	2.2	35	0.56	460	6	1.2	11	21	830	9	30	2600	62	24
156578	33	2.4	33	0.67	650	10	1.2	13	28	770	10	34	2900	70	25
156579	27	2.7	36	0.78	650	<4	1.3	12	18	740	7	14	3300	62	24
156580	18	2.6	32	0.86	590	<4	2.0	10	17	780	7	25	3000	55	22
156581	20	2.9	37	0.89	480	<4	2.0	9	19	1000	8	18	3200	60	25
156583	18	2.7	33	0.89	640	<4	1.9	11	17	920	8	24	3400	60	23
155584	30	2.8	36	0.80	680	<4	1.1	10	21	940	8	14	3100	66	21
156586	31	3.7	29	1.1	510	<4	2.4	10	31	2000	10	36	4200	74	34
156587	24	3.2	41	1.6	580	<4	1.5	8	29	870	9	17	3000	73	20
156588	20	5.2	16	0.39	450	<4	1.6	7	16	3100	7	59	4700	81	48
156589	17	2.6	30	0.52	550	<4	0.78	13	16	1200	7	11	3000	58	28
156590	23	3.0	38	1.2	630	<4	1.0	18	21	1000	8	12	3600	71	22
156591	25	3.5	34	1.2	660	<4	1.2	23	29	780	10	17	3800	76	24
156592	19	2.9	30	0.91	630	<4	1.4	15	20	1400	10	16	4300	70	28
156593	25	4.0	32	1.0	740	<4	1.3	58	25	1400	10	11	5500	82	28
156598	25	3.4	31	1.2	700	<4	1.4	33	32	1200	11	14	4800	88	24
156603	15	2.4	31	0.56	870	<4	1.4	28	16	670	7	10	4000	52	22
156605	22	2.6	39	0.65	520	<4	1.1	26	20	970	8	13	3300	57	23
156609	17	2.0	28	0.54	240	<4	0.77	12	13	640	7	12	2400	48	20
156613	25	3.2	34	1.0	460	<4	1.1	23	23	830	10	17	3200	75	20
156614	13	1.9	21	0.68	610	<4	0.47	14	13	690	6	8	2300	46	13
156616	20	4.3	28	1.0	830	<4	1.4	61	24	1400	12	13	4800	94	23
156622	16	2.7	30	0.58	1900	<4	1.5	33	18	980	7	13	2600	53	22
156624	27	4.4	32	0.69	900	<4	1.6	45	30	1400	10	14	4100	83	22
156628	25	4.1	34	1.0	1300	<4	1.5	40	24	1300	12	13	4700	96	24
156630	24	3.5	36	0.87	670	<4	1.7	23	23	990	12	5	4100	100	19
156634	14	2.1	28	0.70	330	<4	0.66	6	20	740	7	9	2100	56	15
156635															
156636	4	2.0	37	0.23	380	<4	1.7	27	<2	470	7	110	1800	17	73
156637	16	3.4	38	0.75	1400	<4	1.3	39	26	1300	10	17	3300	71	19
156640	19	3.4	42	0.79	790	<4	0.98	26	28	1300	9	20	2600	67	20
156644	19	4.3	38	0.54	780	<4	2.4	120	20	1900	9	20	5600	63	40
156645	21	4.4	36	0.86	750	<4	2.6	130	16	2200	9	29	5800	64	42
156647	24	3.8	38	1.0	700	<4	1.5	54	26	1300	10	23	4500	68	30

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
156528	81	31	1.7	82	54								
156529	89	62	2.0	94	67								
156532	67	32	2.3	150	120								
156535	74	69	1.8	170	120								
156537	120	32	1.8	180	100	7800							
156538	100	60	1.8	140	82	7800							
156539	88	71	1.6	150	84	5400							
156540	87	23	1.5	120	62	6000							
156541	81	52	1.5	170	88	6000							
156546	27	19	2.7	150	55								
156549	76	71	1.8	180	81	6600							
156552	40	35	2.6	160	94	7200							
156554	38	30	2.8	180	81	7200							
156556	27	31	2.3	160	83	7200							
156557	69	91	1.6	150	95	7500							
156562	130	52	1.2	200	71								
155564	77	69	1.3	150	82	5400							
155568	57	64	1.0	120	56								
156569	57	35	1.4	86	45								
155573	79	65	2.7	230	120								
156575	45	30	1.8	260	110								
156576	77	84	1.9	220	85								
156578	84	100	1.8	190	93								
156579	80	110	1.9	190	83								
156580	64	70	1.9	230	93								
156581	75	82	2.0	260	100								
156583	68	81	1.8	250	92								
156584	110	100	1.9	190	71								
156586	88	28	1.9	300	180								
156587	82	78	2.0	200	73								
156588	46	40	1.2	250	330								
156589	64	81	2.0	210	87								
156590	87	79	1.6	200	74								
156591	91	60	1.5	170	99								
156592	73	63	1.5	180	98								
156593	110	47	1.7	170	120								
156598	82	49	1.3	210	91								
156603	67	65	1.6	170	86								
156605	95	65	1.6	160	91								
156609	73	68	1.2	170	80								
156613	85	36	1.5	210	79								
156614	48	27	0.70	260	40								
156616	96	16	2.0	140	120								
156622	74	36	1.9	140	91								
156624	110	30	2.1	150	130								
156628	94	35	1.9	170	100								
156630	110	42	1.7	210	87								
156634	78	46	1.5	180	61								
156635													
156636	65	160	2.5	80	240								
156637	96	39	2.3	180	110								
156640	94	39	2.1	160	100								
156644	130	47	1.9	230	220								
156645	150	40	1.9	220	240								
156647	120	53	2.4	170	150								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
156650	40	41.894	-113.702	-3-15-	2.3	3.6	0.64	<2	7.1	21	910	2	0.84	9	59
156651	40	41.883	-113.693	-3-15-	2.1	3.8	0.56	<2	6.0	16	740	2	0.63	10	56
156653	40	41.880	-113.693	-3-15-	4.0	4.2	0.95	<2	6.6	10	730	3	0.69	7	51
155654	40	41.859	-113.688	-3-15-	2.5	4.8	0.53	<2	6.6	14	840	4	0.63	7	57
156655	40	41.851	-113.716	-3-15-	2.6	3.6	0.72	<2	6.7	20	730	2	3.8	9	53
156658	40	41.849	-113.573	-3-12-	2.9	4.4	0.66	<2	3.2	10	390	1	0.84	4	33
156659	40	41.852	-113.590	-3-12-	4.2	4.7	0.89	<2	6.1	19	680	2	3.1	7	55
156661	40	41.916	-113.585	-3-15-	1.5	2.1	0.71	<2	3.9	14	450	1	13.	5	31
156662	40	41.916	-113.595	-3-15-	2.1	3.2	0.67	<2	5.2	30	630	2	2.5	6	40
156663	40	41.894	-113.586	-3-15-	1.8	3.5	0.53	<2	5.9	15	680	2	4.2	7	44
156665	40	41.892	-113.604	-3-15-	3.1	4.1	0.77	<2	5.5	22	680	2	1.2	8	56
155666	40	41.892	-113.609	-3-12-	1.6	3.0	0.55	<2	4.9	19	670	2	2.4	7	38
156672	40	41.908	-113.611	-3-12-	1.9	4.1	0.46	<2	6.5	<10	660	3	1.1	4	41
156673	40	41.944	-113.700	-3-15-	2.6	4.0	0.66	<2	6.0	18	810	2	1.3	8	49
156676	40	41.937	-113.694	-3-15-	3.1	6.1	0.51	<2	6.4	<10	720	3	0.84	8	52
155678	40	41.934	-113.553	-3-15-	3.5	5.4	0.65	<2	6.7	<10	760	4	1.8	5	38
156679	40	41.946	-113.540	-3-15-	3.5	5.2	0.67	<2	5.4	14	740	3	1.8	7	50
156681	40	41.924	-113.544	-3-15-	2.9	3.5	0.84	<2	6.6	11	810	4	1.1	8	53
156682	40	41.930	-113.540	-3-15-	3.0	5.0	0.59	<2	5.8	12	730	3	1.1	5	39
156683	40	41.910	-113.547	-3-15-	2.6	3.0	0.87	<2	4.2	33	580	2	1.2	4	48
156688	40	41.864	-113.799	-3-12-	2.7	4.5	0.61	<2	6.2	<10	620	4	1.0	7	49
156689	40	41.869	-113.792	-3-15-	3.1	3.9	0.78	<2	8.0	25	1100	3	0.99	11	65
156691	40	41.891	-113.809	-3-12-	2.3	3.0	0.76	<2	5.4	22	620	2	1.5	6	51
156693	40	41.882	-113.804	-3-15-	3.1	3.7	0.83	<2	6.2	26	740	2	0.85	8	46
156694	40	41.886	-113.795	-3-12-	12.	13.	0.96	<2	7.2	10	780	4	1.4	8	51
156697	40	41.996	-113.727	-3-15-	2.8	5.2	0.54	<2	8.0	<10	950	2	2.3	10	62
156701	40	41.999	-113.521	-3-15-	5.8	9.3	0.62	<2	7.0	<10	630	3	2.2	4	46
156702	40	41.998	-113.525	-3-15-	4.6	4.6	0.99	<2	6.2	21	720	2	2.6	7	44
156704	40	41.987	-113.517	-3-15-	3.0	3.9	0.78	<2	7.6	<10	710	3	1.7	5	37
156705	40	41.978	-113.503	-3-15-	3.7	15.	0.25	<2	6.4	<10	710	2	2.7	6	39
155706	40	41.970	-113.735	-3-15-	2.6	5.1	0.51	<2	6.9	11	760	2	1.9	6	33
155708	40	42.166	-113.706	-3-15-	12.	14.	0.88	<2	6.8	11	1500	3	1.7	6	29
156712	40	42.173	-113.647	-3-15-	4.5	5.8	0.77	<2	7.7	<10	960	2	0.97	6	28
156714	40	42.175	-113.636	-3- -	12.	14.	0.87	<2	7.3	<10	1100	2	1.2	4	23
156715	40	42.204	-113.703	-3-15-	2.7	4.2	0.65	<2	5.5	20	790	2	1.0	8	44
156716	40	42.204	-113.699	-3-15-	1.1	1.8	0.59	<2	3.5	<10	290	1	9.6	4	24
156717	40	42.203	-113.697	-3-15-	2.4	3.0	0.81	<2	4.7	12	610	2	1.0	8	36
156721	40	42.199	-113.693	-3-15-	3.6	5.3	0.69	<2	6.5	13	880	2	0.99	6	28
156722	40	42.196	-113.692	-3-12-	7.2	8.8	0.82	<2	7.2	<10	1000	3	1.3	4	22
156726	40	42.333	-113.641	-3-15-	2.3	3.6	0.63	<2	5.0	18	680	2	0.77	8	37
156727	40	42.340	-113.639	-3-15-	3.3	3.6	0.92	<2	5.4	14	740	2	0.67	7	38
156729	40	42.376	-113.637	-3-15-	3.1	3.3	0.93	<2	4.8	14	660	2	0.87	6	35
156734	40	42.375	-113.637	-3-12-	1.7	2.4	0.70	<2	3.0	<10	460	1	0.33	5	35
156735	40	42.375	-113.636	-3-15-	2.8	4.3	0.64	<2	6.0	18	910	2	1.1	10	40
156743	40	42.078	-113.821	-3-12-	3.4	4.6	0.73	<2	8.2	<10	930	5	5.4	7	62
156745	40	42.004	-113.769	-3-15-	3.3	3.9	0.84	<2	5.5	35	790	2	4.9	7	34
156747	40	42.033	-113.783	-3-15-	2.2	3.9	0.56	<2	5.5	20	800	2	1.1	8	33
156749	40	42.032	-113.803	-3-12-	2.3	8.5	0.27	<2	6.5	<10	1200	3	1.5	4	20
156750	40	42.046	-113.767	-3-15-	1.5	3.0	0.50	<2	6.6	17	880	3	3.2	6	31
156751	40	42.072	-113.769	-3-15-	3.8	4.9	0.79	<2	6.1	19	820	2	1.3	5	36
156752	40	42.109	-113.777	-3-12-	2.4	4.8	0.51	<2	7.3	<10	1200	3	1.8	4	34
156754	40	42.139	-113.792	-3-12-	2.8	3.7	0.77	<2	5.2	16	760	2	1.9	6	39
156756	40	42.150	-113.798	-3-12-	2.9	4.2	0.68	<2	6.0	<10	710	2	2.2	8	57
156758	40	42.162	-113.804	-3-12-	3.9	12.	0.32	<2	5.5	<10	790	2	1.8	4	32
156760	40	42.174	-113.814	-3-15-	2.8	4.3	0.64	<2	5.7	16	740	2	1.7	7	40

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
156650	26	3.1	39	0.86	680	<4	0.89	9	28	820	9	17	3000	66	19
156651	21	2.9	25	0.71	540	<4	0.78	10	26	750	8	19	2800	56	14
156653	21	3.1	31	0.68	650	<4	1.7	47	18	1100	8	13	3700	58	24
156654	18	3.5	25	0.70	740	<4	1.1	73	21	1300	10	20	4800	74	28
156655	22	2.9	43	0.92	640	<4	0.67	9	27	880	10	8	2800	70	24
156658	13	1.6	15	0.40	280	<4	0.43	6	12	640	5	12	2700	40	12
156659	15	2.4	39	0.87	550	<4	0.66	5	26	790	10	15	2200	59	22
156661	12	1.7	27	1.3	380	<4	0.46	14	12	560	5	8	1700	42	13
156662	17	2.5	31	0.94	610	<4	0.75	11	16	850	7	11	2900	58	20
156663	15	2.2	39	0.83	470	<4	0.55	9	18	450	8	12	2400	61	22
156665	21	2.4	32	0.66	540	<4	0.63	8	20	880	7	14	2600	57	22
156666	14	2.2	27	0.57	4100	<4	0.68	6	16	840	6	7	2300	44	20
156672	11	2.5	27	0.61	650	<4	2.2	54	13	1400	7	11	4200	48	24
156673	21	2.9	29	0.93	520	<4	1.2	12	21	760	8	14	3100	64	18
156676	20	3.9	23	0.62	750	<4	1.8	50	22	2000	8	18	6800	82	30
156678	14	3.4	26	0.75	830	<4	2.3	110	15	2100	7	19	5300	54	34
156679	15	3.1	23	0.74	630	<4	0.89	38	17	2400	8	14	4400	62	40
156681	21	3.8	29	0.91	780	<4	1.6	79	24	1700	9	18	5000	67	32
156682	13	3.2	25	0.66	650	<4	1.7	59	18	1900	7	18	5400	51	31
156683	13	1.6	23	0.44	310	<4	0.58	7	13	740	5	10	2000	39	18
156688	19	3.4	23	0.74	710	<4	2.0	74	22	2200	8	19	6000	64	37
156689	29	3.6	54	0.77	750	<4	0.74	11	30	1100	11	13	3400	81	25
156691	18	2.0	30	0.86	230	<4	0.56	8	19	1800	6	10	2300	55	22
156693	28	2.7	34	0.69	900	<4	0.77	8	18	1100	8	10	2800	64	22
156694	24	3.7	44	0.87	750	<4	1.3	56	24	1300	10	7	4900	74	31
156697	24	3.9	36	1.1	630	<4	2.2	10	23	2100	10	20	4600	79	32
155701	16	3.2	25	0.70	850	<4	2.3	14	17	930	9	25	6600	59	25
156702	20	2.6	34	1.0	530	<4	1.4	10	20	730	7	21	2800	59	20
156704	17	2.6	31	0.72	410	<4	2.2	10	17	870	7	24	3000	50	23
156705	13	3.1	22	0.62	520	<4	2.0	15	15	2700	8	37	4900	62	40
156706	16	2.6	27	0.77	480	<4	1.8	11	17	1300	7	23	2900	53	25
156708	19	2.9	41	0.81	490	<4	1.4	10	16	2300	7	20	3100	56	31
156712	13	2.7	32	0.66	430	<4	1.7	13	14	970	7	44	2800	50	20
156714	7	2.4	22	0.59	360	<4	1.9	13	11	1100	6	52	2400	37	28
156715	23	2.5	35	0.76	850	<4	0.53	6	19	1400	7	11	2600	59	14
156716	11	1.6	20	4.2	530	<4	0.41	6	12	810	4	3	1300	32	11
156717	17	2.3	30	0.82	760	<4	0.58	5	19	920	6	5	2300	52	22
156721	11	2.8	33	0.66	570	<4	1.2	14	12	1300	7	28	3100	52	17
156722	9	2.7	28	0.51	390	<4	1.9	13	10	1200	6	44	3200	47	28
156726	22	2.3	37	0.61	1000	<4	0.64	8	17	1000	6	11	2400	59	14
156727	18	2.4	39	0.59	940	<4	0.68	7	17	900	6	12	2700	59	13
156729	19	2.2	34	0.53	800	<4	0.62	5	15	900	5	10	2400	54	13
156734	6	2.1	11	0.41	240	<4	0.19	7	12	440	5	4	2500	50	11
156735	21	2.5	37	0.68	970	<4	0.67	7	19	1500	7	12	2800	53	17
156743	13	3.0	67	2.0	330	<4	1.0	22	16	740	13	15	4300	54	32
156745	18	2.3	37	1.3	600	<4	1.0	14	18	750	7	12	2500	57	21
156747	18	2.0	27	0.60	690	<4	1.0	17	14	650	6	22	2700	51	22
156749	10	1.8	29	0.53	500	<4	1.6	15	9	700	5	24	2400	35	22
156750	14	2.3	36	0.81	430	<4	1.2	10	17	520	6	7	2500	48	20
156751	17	2.3	34	0.62	480	<4	1.1	11	13	680	7	15	3100	59	23
156752	8	1.6	25	0.55	310	<4	1.3	7	12	840	6	15	2500	42	19
156754	14	2.2	24	0.67	400	<4	1.1	11	14	650	6	13	3600	58	18
156756	12	3.3	24	1.0	690	<4	1.4	15	21	740	11	14	6200	85	21
156758	32	2.4	19	0.70	620	<4	1.3	15	10	1000	7	21	5100	54	29
155760	18	2.6	27	0.93	510	<4	0.95	12	19	960	8	18	3400	60	25

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
156650	95	71	2.2	150	83								
156651	81	42	1.4	120	86								
156653	90	49	1.7	160	120								
156654	95	25	1.7	130	160								
156655	89	55	1.7	250	88								
156658	34	25	0.88	110	65								
156659	75	30	1.6	270	91								
156661	51	53	0.93	290	40								
156662	72	84	1.3	190	72								
156663	61	53	1.4	250	100								
156665	70	75	1.3	160	83								
156666	56	57	1.2	180	58								
156672	74	35	1.3	180	110								
156673	68	53	1.6	150	78								
156676	76	25	1.5	130	140								
156678	110	37	1.5	190	180								
156679	58	41	1.9	180	130								
156681	100	39	1.6	170	160								
156682	78	54	1.5	160	160								
156683	62	88	1.1	160	52								
156688	77	22	1.3	190	150								
156689	110	80	2.1	170	90								
156691	150	72	1.7	130	60								
156693	120	100	1.8	150	73								
156694	110	64	1.6	180	98								
156697	100	57	1.9	350	140								
156701	65	49	1.5	200	110								
156702	71	83	1.7	260	84								
156704	63	70	1.6	230	110	3000							
156705	55	51	1.5	290	200								
156706	67	77	1.5	240	110								
156708	96	41	1.5	400	140								
156712	66	36	1.9	170	130								
156714	47	18	2.0	180	190								
156715	110	56	1.3	150	65								
156716	52	22	1.0	76	24								
156717	68	43	1.5	100	58								
156721	99	50	1.5	160	110								
156722	66	30	1.9	190	210								
156726	100	69	1.2	130	57								
156727	90	64	1.3	140	61								
156729	80	55	1.2	130	51								
156734	38	6	1.3	87	42								
156735	70	56	2.1	210	69								
156743	92	21	2.0	450	110								
156745	75	100	1.8	270	65								
156747	70	96	1.5	200	91								
156749	66	55	1.8	250	120								
156750	68	82	1.5	220	61								
156751	77	100	1.5	210	82								
156752	36	17	2.2	260	94								
156754	57	70	1.4	220	79								
156756	67	67	1.3	240	96								
156758	53	34	1.5	200	160								
156760	64	65	1.7	150	98								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
156761	40-42.173	-113.790	-3-15-	2.2	3.4	0.65	<2	5.8	20	770	2	1.1	6	36
156763	40-42.160	-113.759	-3-12-	7.2			<2	5.5	<10	560	3	1.5	<4	24
156765	40-42.194	-113.754	-3-12-	3.1	5.5	0.56	<2	5.3	<10	530	3	3.1	7	48
156767	40-42.194	-113.743	-3-12-	4.2	5.1	0.82	<2	5.6	10	510	2	2.5	11	54
156768	40-42.196	-113.735	-3-15-	2.9	3.8	0.75	<2	5.4	19	790	2	1.3	8	39
156769	40-42.197	-113.803	-3-15-	3.4	3.4	0.99	<2	5.6	25	760	2	1.4	6	35
155771	40-42.323	-113.588	-3-12-	1.8	3.9	0.47	<2	3.8	14	560	2	0.59	4	29
156772	40-42.324	-113.577	-3-15-	2.8	5.0	0.57	<2	5.6	16	820	2	0.96	5	35
156773	40-42.324	-113.566	-3-15-	2.8	4.4	0.63	<2	6.5	27	910	3	0.88	10	46
155774	40-42.327	-113.550	-3-15-	2.2	4.5	0.49	<2	6.1	27	910	2	0.96	11	47
156775	40-42.326	-113.544	-3-15-	3.1	4.0	0.77	<2	5.9	25	930	2	0.91	9	44
156777	40-42.326	-113.544	-3-15-	3.2	3.5	0.92	<2	5.8	29	910	2	1.1	8	42
156778	40-42.314	-113.598	-3-12-	0.67	1.8	0.37	<2	2.6	<10	250	1	0.21	<4	25
156779	40-42.315	-113.634	-3-15-	2.5	3.2	0.78	<2	6.6	13	760	2	0.91	9	53
156781	40-42.311	-113.614	-3-15-	2.3	4.5	0.50	<2	5.4	17	750	2	0.34	6	43
156782	40-42.309	-113.592	-3-15-	3.1	4.3	0.72	<2	5.9	21	820	2	0.71	9	43
156785	40-41.680	-113.739	-3-15-	7.8	9.5	0.82	<2	8.5	<10	670	1	1.7	6	34
156787	40-42.302	-113.634	-3-15-	3.4	4.2	0.81	<2	5.9	14	810	2	0.92	10	77
156789	40-42.302	-113.634	-3-12-	3.1	5.7	0.54	<2	5.0	14	700	2	0.63	8	110
156790	40-42.288	-113.628	-3-15-	4.0	5.8	0.70	<2	5.9	17	800	3	0.87	9	83
156794	40-41.956	-113.309	-3-12-	32.	29.	1.1	<2	6.0	<10	650	2	1.3	10	47
156796	40-42.102	-113.729	-3-15-	3.0	4.1	0.73	<2	6.5	17	940	2	1.2	6	42
156798	40-42.086	-113.744	-3-12-	3.4	7.6	0.45	<2	6.5	<10	900	2	2.1	5	31
156801	40-42.014	-113.722	-3-15-	4.4	6.1	0.72	<2	8.8	<10	720	2	1.4	7	28
156802	40-42.015	-113.709	-3-91-	6.3	6.5	0.96	<2	7.6	10	650	3	1.1	9	63
156803	40-42.002	-113.716	-3-15-	4.0	4.7	0.86	<2	7.1	17	870	2	1.1	5	32
156804	40-42.006	-113.727	-3-15-	3.4	6.1	0.55	<2	8.6	<10	700	2	1.5	8	58
156805	40-42.007	-113.739	-3-15-	4.7	6.4	0.73	<2	9.0	<10	650	3	1.8	7	45
156806	40-42.033	-113.707	-3-15-	2.0	4.5	0.45	<2	8.0	<10	440	3	1.7	8	60
156810	40-41.627	-113.692	-3-12-	2.9	5.2	0.56	<2	6.8	<10	770	2	1.8	<4	31
156818	40-42.335	-113.615	-3-15-	3.0	4.1	0.74	<2	5.6	23	800	2	0.83	7	45
156819	40-42.354	-113.585	-3-15-	3.1	4.1	0.75	<2	5.1	17	790	2	1.1	7	50
156821	40-42.359	-113.625	-3-12-	3.9	5.0	0.78	<2	5.5	23	830	2	0.83	9	47
156825	40-42.363	-113.617	-3-12-	5.5	7.4	0.74	<2	4.8	15	750	2	0.74	7	43
156827	40-41.845	-113.793	-3-15-	5.7	5.9	0.96	<2	5.6	20	590	2	1.9	9	62
156828	40-41.839	-113.801	-3-12-	5.1	5.3	0.96	<2	5.8	25	600	2	2.1	7	52
156830	40-41.827	-113.651	-3-12-	4.9	5.6	0.87	<2	6.6	<10	750	3	2.4	11	77
156832	40-41.804	-113.805	-3-15-	5.6	5.5	1.0	<2	6.1	21	810	2	1.5	7	48
156834	40-41.827	-113.766	-3-15-	4.6	4.8	0.96	<2	6.5	22	840	3	0.91	7	51
156835	40-41.847	-113.769	-3-15-	4.2	4.4	0.95	<2	6.0	22	800	2	1.2	8	56
156836	40-41.857	-113.770	-3-15-	3.5	4.5	0.78	<2	6.1	20	800	2	1.3	8	56
156837	40-41.861	-113.770	-3-12-	34.	37.	0.94	<2	5.8	14	700	2	1.3	7	50
156839	40-41.868	-113.774	-3-15-	3.4	5.0	0.68	<2	6.7	<10	720	4	2.1	13	79
156842	40-42.166	-113.715	-3-12-	4.4	4.9	0.90	<2	8.1	<10	680	3	1.2	5	28
156843	40-42.095	-113.520	-3-15-	3.2	4.8	0.68	<2	6.3	14	790	2	0.76	11	51
156844	40-42.080	-113.523	-3-15-	3.3	4.6	0.72	<2	6.4	20	790	2	0.76	9	52
156845	40-42.073	-113.532	-3-15-	3.4	4.1	0.83	<2	6.3	17	770	2	0.68	9	48
156846	40-42.312	-113.537	-3-15-	3.3	4.1	0.81	<2	6.0	19	750	2	0.72	8	48
156847	40-42.312	-113.546	-3-15-	5.5	5.1	1.1	<2	5.5	20	800	2	1.4	6	44
156848	40-42.305	-113.555	-3-15-	6.6	6.0	1.1	<2	6.6	<10	540	4	1.3	22	120
155851	40-42.106	-113.716	-3-15-	2.0	3.1	0.65	<2	9.2	<10	1100	3	2.2	<4	11
156852	40-42.104	-113.707	-3-15-	2.6	4.0	0.65	<2	7.4	<10	780	3	1.5	<4	51
156853	40-42.098	-113.702	-3-15-	2.9	4.6	0.64	<2	7.8	<10	910	3	1.6	4	54
156854	40-42.094	-113.691	-3-15-	3.9	5.8	0.68	<2	8.8	<10	370	3	1.4	<4	50
156856	40-42.091	-113.681	-3-15-	2.5	4.3	0.57	<2	7.8	10	670	2	1.7	6	39

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
156761	16	2.3	27	0.73	390	<4	1.1	9	16	760	7	13	2900	54	21
156763	19	1.5	13	0.47	470	<4	1.7	17	8	1200	6	20	3600	33	30
156765	8	4.4	13	1.0	820	<4	0.68	23	15	2200	15	17	6900	110	50
156767	36	3.6	27	1.2	680	<4	1.0	20	22	1300	12	11	5400	97	28
156768	18	2.6	42	0.84	950	<4	0.86	12	18	1100	8	14	3600	65	20
156769	19	2.4	28	0.75	550	<4	1.0	11	15	1100	7	15	3100	56	21
156771	10	1.9	22	0.35	500	<4	0.50	9	15	550	5	3	4400	43	29
156772	18	2.5	45	0.69	930	<4	0.78	<4	12	1400	6	<2	2900	56	13
156773	29	3.0	61	0.60	1000	<4	0.94	8	22	1400	8	6	3400	77	21
156774	20	2.6	52	0.71	1000	<4	0.81	9	21	1100	8	14	3100	68	13
156775	24	2.5	42	0.66	1100	<4	0.80	8	21	1500	8	15	3000	65	16
156777	30	2.5	39	0.70	980	<4	0.77	6	20	1600	8	10	2800	63	17
156778	5	0.91	12	0.21	110	<4	0.25	<4	7	310	3	8	1100	27	6
156779	16	2.8	40	0.57	520	<4	0.86	6	22	960	9	15	2700	71	19
156781	12	2.9	25	0.52	420	<4	0.38	7	16	1000	8	11	3100	56	12
156782	18	3.1	42	0.62	1000	<4	0.68	7	20	1300	8	7	2800	67	22
156785	24	2.1	33	0.58	410	<4	2.4	4	14	330	7	30	2200	42	13
156787	20	2.5	38	0.57	850	<4	0.61	6	23	1100	8	10	2500	69	24
156789	11	2.9	21	0.51	530	<4	0.50	15	19	1000	7	12	3400	58	22
156790	26	2.7	39	0.65	890	<4	0.82	7	28	850	8	11	3000	63	34
156794	25	3.1	37	0.94	810	<4	1.1	6	23	840	10	16	2600	72	23
156796	24	2.6	40	0.59	520	<4	0.97	8	16	1200	7	8	2600	50	26
156798	9	2.4	22	0.66	690	<4	1.6	13	12	1300	8	20	4600	58	33
156801	18	3.1	39	0.79	540	<4	2.3	8	14	780	8	34	3200	56	17
156802	28	3.2	38	0.83	660	<4	1.6	9	27	670	9	17	3100	65	20
156803	17	2.6	36	0.58	570	<4	1.5	17	16	610	7	12	3100	49	31
156804	22	3.2	30	0.93	560	<4	2.7	8	29	600	9	30	3300	60	18
156805	21	3.0	34	0.77	610	<4	3.0	10	21	770	9	34	3100	57	21
156806	23	3.0	23	0.60	530	<4	2.5	7	30	420	8	16	4100	61	12
156810	14	1.4	27	0.41	170	<4	2.3	5	15	450	4	5	1500	35	9
156818	18	2.8	41	0.60	780	<4	0.71	8	17	1400	7	11	3100	61	19
156819	19	2.4	26	0.67	700	<4	0.87	7	19	1300	7	14	3000	62	17
156821	20	2.6	29	0.57	720	<4	0.58	7	19	1200	8	9	2900	60	28
156825	12	2.2	24	0.50	510	<4	0.69	6	17	940	6	9	2400	46	20
156827	28	3.2	33	1.0	510	<4	0.74	12	27	1300	9	18	3400	79	20
156828	24	2.7	25	0.87	430	<4	0.51	8	19	1300	8	10	2500	73	20
156830	20	3.9	31	1.2	810	<4	1.4	15	30	1100	12	18	4700	110	23
156832	22	2.5	31	0.79	580	<4	0.95	10	18	1000	7	12	3100	70	22
156834	27	2.8	45	0.69	760	<4	0.87	10	22	1000	9	13	3100	68	34
156835	32	3.0	37	0.79	730	<4	0.80	13	23	1100	9	13	3700	75	25
156836	36	3.0	43	0.89	730	<4	0.96	14	25	1100	8	15	2900	62	19
156837	25	2.7	38	0.84	480	<4	0.95	13	21	720	8	18	2600	53	19
156839	23	5.0	33	1.2	1100	<4	1.4	60	37	1200	13	12	8100	120	30
155842	11	3.4	29	0.55	380	<4	2.2	13	10	1200	6	13	2500	56	25
155843	24	3.2	27	0.60	580	<4	0.69	9	21	1200	9	10	3400	75	19
156844	20	2.8	31	0.67	620	<4	0.63	8	19	910	9	11	3100	69	18
156845	21	2.7	34	0.68	740	<4	0.68	7	18	1100	8	9	3000	68	15
156846	21	2.6	38	0.62	720	<4	0.70	7	17	910	8	9	3000	68	16
156847	43	2.4	33	0.71	590	<4	0.58	6	25	1300	8	13	2100	54	54
156848	45	5.9	37	1.6	920	<4	1.1	4	56	920	20	15	6700	180	29
156851	7	1.8	33	0.40	340	<4	3.0	7	4	780	4	11	1700	24	12
156852	10	1.4	42	0.36	420	<4	2.6	10	6	480	4	4	1400	25	13
156853	22	2.1	42	0.47	370	<4	2.6	12	7	690	5	28	2300	33	13
156854	14	1.1	23	0.19	290	<4	3.9	17	4	580	2	25	1500	15	14
156856	11	3.2	46	0.71	470	<4	2.5	14	11	970	7	32	3700	52	15

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
156761	65	79	1.8	210	74								
156763	26	13	1.8	180	110								
156765	45	13	2.0	250	140								
156767	86	42	1.4	240	86								
156768	78	67	1.6	190	74								
156769	82	80	1.7	240	76								
156771	50	43	1.2	110	44								
156772	99	70	1.8	180	26								
156773	110	96	1.7	180	58								
156774	71	70	1.9	190	66								
156775	95	78	2.0	190	70								
156777	110	80	1.7	200	55								
156778	40	23	0.98	47	27								
156779	82	48	1.8	250	80								
156781	50	40	2.7	170	69								
156782	91	79	1.9	160	70								
156785	52	20	1.7	150	66								
156787	100	62	1.4	160	71								
156789	47	24	2.4	160	79								
156790	86	77	1.6	160	73								
156794	66	38	1.7	150	73								
156796	84	58	2.1	230	79								
156798	53	39	1.8	270	220								
156801	110	42	1.8	180	120								
156802	98	72	1.8	150	70								
156803	81	190	2.1	180	95								
156804	67	29	1.8	170	100								
156805	79	22	1.9	170	120								
156806	52	11	1.2	150	53								
156810	72	20	1.7	160	38								
156818	73	77	1.9	160	73								
156819	60	61	1.4	160	77								
156821	61	63	1.9	180	76								
156825	40	42	1.8	150	71								
156827	120	57	1.2	150	68								
156828	92	81	1.4	160	64								
156830	72	21	1.6	170	88								
156832	83	110	1.6	230	79								
156834	120	110	1.4	170	91								
156835	110	89	1.4	180	75								
156836	130	63	1.6	170	82								
156837	82	48	1.4	150	83								
156839	99	38	1.4	160	110								
156842	81	16	1.6	150	71								
156843	68	72	2.3	170	63								
156844	76	77	2.1	160	67								
156845	89	79	1.8	150	58								
156846	92	81	1.8	140	63								
156847	130	72	1.4	160	60								
156848	150	30	1.8	120	44								
156851	63	14	1.5	350	80								
156852	68	27	1.8	230	36								
156853	73	23	1.8	220	110								
156854	35	12	1.6	120	74								
156856	94	33	1.7	210	130								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
156857	40	42.178	-113.691	-3-15-	3.7	4.8	0.77	<2	7.6	<10	470	3	1.9	15	96
156860	40	42.165	-113.702	-3-15-	3.3	4.8	0.68	<2	7.7	11	730	3	1.2	17	76
158513	40	41.681	-113.783	-3-15-	11.	15.	0.71	<2	7.8	<10	630	3	1.3	<4	34
158514	40	41.676	-113.778	-3-12-	14.	21.	0.64	<2	7.4	<10	580	3	1.5	5	27
158516	40	41.671	-113.785	-3-12-	7.5	13.	0.56	<2	7.3	13	900	2	2.3	4	56
158518	40	41.671	-113.802	-3-15-	2.3	3.0	0.76	<2	4.8	35	500	2	2.0	4	72
158523	40	41.952	-113.844	-3-12-	3.3	3.9	0.84	<2	4.1	21	540	2	2.9	5	49
158525	40	41.952	-113.694	-3-15-	10.	8.1	1.3	<2	6.2	12	520	2	1.7	15	98
158527	40	41.950	-113.674	-3-15-	3.9	4.5	0.87	<2	6.4	12	540	2	1.7	14	110
158530	40	41.966	-113.683	-3-15-	12.	14.	0.88	<2	6.6	12	690	4	0.73	5	42
158532	40	41.985	-113.692	-3-15-	6.3	6.9	0.91	<2	6.3	20	730	2	1.4	8	48
158534	40	41.788	-113.671	-3-15-	4.2	4.5	0.93	<2	6.3	22	670	2	1.2	11	84
158537	40	41.780	-113.671	-3-12-	3.2	4.5	0.72	<2	6.9	15	580	2	0.58	14	120
158539	40	41.783	-113.684	-3-12-	2.5	4.0	0.63	<2	6.5	16	660	2	0.69	11	79
158541	40	41.792	-113.686	-3-15-	3.0	3.8	0.80	<2	5.9	22	670	2	1.0	12	71
158543	40	41.792	-113.706	-3-15-	3.0	3.8	0.80	<2	6.5	26	660	2	1.2	14	81
158549	40	41.634	-113.754	-3-15-	4.5	5.3	0.85	<2	5.2	20	630	2	0.80	5	32
158551	40	41.858	-113.509	-3-15-	83.	70.	1.2	<2	5.3	15	550	2	0.76	5	29
158552	40	41.858	-113.511	-3-15-	4.4	6.7	0.66	<2	6.1	<10	570	3	0.68	<4	23
158555	40	41.849	-113.514	-3-15-	9.2	9.2	1.00	4	2.9	<10	370	1	0.37	<4	16
158557	40	41.855	-113.495	-3-12-	40.	40.	1.0	<2	5.3	15	520	2	0.90	5	26
158558	40	41.856	-113.494	-3-15-	33.	31.	1.1	<2	5.8	14	550	2	0.95	5	27
158561	40	41.858	-113.447	-3-15-	24.	23.	1.0	<2	5.1	25	660	2	1.0	7	37
158563	40	41.856	-113.456	-3-12-	11.	10.	1.1	<2	4.0	20	490	1	0.96	4	32
158564	40	41.856	-113.461	-3-12-	23.	22.	1.0	<2	3.8	20	470	1	1.0	4	29
158565	40	41.855	-113.468	-3-15-	62.	54.	1.2	<2	5.3	16	550	2	1.0	11	66
158567	40	41.864	-113.479	-3-15-	73.	71.	1.0	<2	5.5	14	490	2	1.2	14	88
158568	40	41.855	-113.394	-3-12-	7.9	7.9	1.0	<2	5.3	12	540	2	0.96	6	38
158576	40	41.862	-113.427	-3-12-	10.0	12.	0.82	<2	5.2	12	560	2	0.93	6	41
158577	40	41.847	-113.645	-3-12-	2.6	3.6	0.71	<2	6.1	19	660	2	1.4	8	49
158581	40	41.848	-113.630	-3-15-	2.7	3.6	0.76	<2	6.4	25	730	2	1.2	9	48
158583	40	41.839	-113.631	-3-15-	3.9	4.2	0.93	<2	5.7	17	690	2	1.0	10	82
158586	40	41.861	-113.621	-3-12-	5.7	7.2	0.79	<2	4.9	22	640	2	1.8	6	36
158589	40	41.752	-113.609	-3-15-	2.7	3.5	0.76	<2	5.6	<10	480	2	3.0	14	65
158594	40	41.742	-113.722	-3-12-	48.	39.	1.2	<2	7.2	<10	430	2	4.6	15	77
158600	40	41.719	-113.772	-3-15-	13.	14.	0.87	<2	7.4	<10	590	3	1.8	10	40
158617	40	41.977	-113.825	-3-12-	4.3	13.	0.32	<2	6.9	<10	780	2	1.9	9	50
158622	40	41.965	-113.817	-3-12-	22.	36.	0.61	<2	6.6	<10	920	2	1.6	6	33
158633	40	41.772	-113.772	-3-12-	6.6	6.8	0.97	<2	7.5	<10	970	2	1.2	4	22
158635	40	41.775	-113.782	-3-15-	7.4	8.4	0.89	<2	7.0	15	840	2	1.4	8	40
158636	40	41.778	-113.786	-3-12-	7.8	8.6	0.90	<2	7.7	<10	980	2	1.3	4	26
158641	40	41.774	-113.751	-3-12-	4.4	5.2	0.84	<2	7.9	<10	950	2	1.5	<4	12
158646	40	41.762	-113.755	-3-12-	6.0	7.5	0.81	<2	8.1	<10	1100	2	1.3	4	54
158648	40	41.761	-113.754	-3-15-	6.9	7.4	0.93	<2	8.0	13	790	2	1.5	7	47
158658	40	41.933	-113.766	-3-15-	3.3	4.7	0.70	<2	6.1	16	800	3	1.5	7	59
158659	40	41.746	-113.697	-3-15-	3.5	3.8	0.91	<2	6.7	21	750	2	1.1	6	47
158661	40	41.746	-113.700	-3-12-	2.8	3.8	0.75	<2	6.0	22	580	2	1.1	8	83
158663	40	41.742	-113.705	-3-12-	34.	30.	1.1	<2	7.8	15	780	2	1.6	10	52
158665	40	41.741	-113.705	-3-12-	22.	22.	1.0	<2	8.1	10	710	2	1.8	9	47
158667	40	41.749	-113.683	-3-12-	4.3	6.0	0.72	<2	7.2	10	680	2	1.9	10	59
158668	40	41.733	-113.685	-3-15-	19.	20.	0.95	<2	8.0	<10	730	2	1.3	9	56
158670	40	41.901	-113.621	-3-12-	3.2	4.1	0.79	<2	6.3	14	780	3	0.89	6	55
158675	40	41.734	-113.703	-3-15-	4.3	4.5	0.95	<2	6.9	<10	750	2	1.4	5	25
158684	40	41.882	-113.428	-3-15-	4.0	6.2	0.64	<2	7.0	<10	780	4	0.59	7	46
158685	40	41.872	-113.438	-3-12-	2.6	4.7	0.55	<2	7.4	17	970	3	0.82	8	50

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
156857	36	5.5	36	1.8	1300	<4	1.6	34	46	2100	17	24	9500	140	35
156860	34	5.3	48	1.6	1300	<4	1.2	23	47	1900	14	16	10000	130	26
158513	20	2.4	53	0.56	630	<4	2.3	20	7	530	5	<2	2300	39	21
158514	20	2.0	41	0.44	850	<4	2.4	18	12	740	5	24	1700	34	20
158516	21	2.1	42	1.2	490	<4	2.1	26	18	900	6	23	1900	42	31
158518	21	2.0	30	0.84	580	<4	0.54	7	21	2200	6	5	2000	49	26
158523	17	1.8	32	1.5	270	<4	0.56	10	20	1100	5	10	1900	47	19
158525	37	3.9	36	1.4	820	<4	1.5	14	56	750	13	6	4700	100	17
158527	41	3.8	36	1.4	700	<4	1.6	<4	59	750	13	3	4100	99	16
158530	27	2.8	33	0.65	520	<4	2.1	77	21	1300	7	14	3800	50	25
158532	26	2.5	40	0.83	650	<4	1.1	7	25	1200	9	12	2900	63	18
158534	31	3.4	39	0.98	740	<4	0.81	14	37	1100	11	14	4000	100	27
158537	28	4.2	36	1.0	680	<4	0.58	5	53	1100	13	17	3100	110	23
158539	28	3.6	35	0.89	500	<4	0.86	7	37	1100	11	11	3400	92	18
158541	33	3.1	37	0.81	740	<4	0.66	8	35	1300	9	17	2600	82	21
158543	38	3.7	37	1.0	680	<4	0.56	7	46	1600	11	17	2900	92	22
158549	17	2.3	35	0.59	620	<4	1.1	29	14	1000	5	11	2700	51	18
158551	38	2.2	28	0.56	530	<4	1.4	23	14	930	5	17	2100	44	18
158552	10	2.3	19	0.48	480	<4	2.7	74	11	1800	5	12	3500	35	22
158555	67	1.9	13	0.26	230	7	0.51	7	7	550	3	15	1000	22	8
158557	17	2.0	24	0.53	400	<4	1.3	11	15	790	5	23	1800	40	23
158558	18	2.3	27	0.60	390	<4	1.4	9	15	720	6	26	2000	45	24
158561	26	2.3	36	0.66	680	<4	0.71	7	17	1000	6	5	2200	55	19
158563	16	1.5	26	0.47	280	<4	0.57	5	14	880	4	7	1600	39	13
158564	21	1.3	25	0.45	330	<4	0.54	5	19	770	5	4	1500	34	24
158565	28	2.8	29	0.57	620	<4	0.81	6	34	700	9	14	2400	69	17
158567	35	3.6	34	1.3	560	<4	0.85	4	48	850	10	9	2500	86	19
158568	15	2.4	23	0.68	360	<4	1.7	31	17	990	8	8	3100	63	15
158576	15	2.2	27	0.62	400	<4	1.6	33	17	970	6	18	2500	49	18
158577	23	2.9	35	0.70	430	<4	0.79	10	23	750	9	13	3500	70	20
158581	24	2.8	37	0.77	520	<4	0.73	8	24	770	8	10	2900	66	21
158583	24	2.9	29	0.82	640	<4	0.71	9	28	730	9	18	3000	69	21
158586	26	1.9	31	0.56	440	<4	0.61	6	21	870	6	6	1900	49	17
158589	48	4.1	24	1.3	890	<4	1.1	10	34	1200	14	13	6900	130	25
158594	21	5.0	13	1.1	1200	<4	1.7	<4	38	530	21	16	7800	150	29
158600	38	3.3	47	0.89	630	<4	1.8	11	22	780	9	22	2900	71	20
158617	21	3.4	23	0.89	890	<4	1.4	13	21	850	9	15	3800	75	24
158622	16	2.2	23	0.63	690	<4	1.6	12	13	710	6	16	2800	45	20
158633	16	2.1	29	0.49	360	<4	2.3	7	14	540	5	34	2100	32	13
158635	24	2.8	32	0.73	610	<4	1.6	9	24	920	7	30	2900	59	19
158636	22	2.2	30	0.59	360	<4	2.3	7	15	670	5	33	2400	45	14
158641	12	1.5	22	0.33	400	<4	3.0	4	10	460	3	22	1300	21	10
158646	12	1.8	23	0.60	340	<4	2.8	5	18	480	5	30	1700	31	12
158648	23	2.8	39	0.81	540	<4	2.3	6	21	720	8	25	2700	53	20
158658	20	2.7	28	0.79	680	<4	1.2	14	21	710	8	19	4300	64	23
158659	19	2.5	29	0.82	550	<4	1.5	9	20	720	7	25	2500	53	20
158661	22	3.0	42	0.81	600	<4	0.72	5	39	1200	9	10	2700	82	22
158663	40	3.9	44	1.0	770	<4	1.2	11	39	1000	12	21	4700	89	35
158665	27	3.3	34	0.85	650	<4	2.0	9	33	660	11	26	3800	74	29
158667	27	3.4	33	0.55	640	<4	1.3	9	40	1100	11	16	4100	84	25
158668	30	3.2	38	0.89	610	<4	1.6	11	38	760	9	24	3000	66	23
158670	18	3.1	33	0.81	570	<4	1.7	55	21	1100	7	10	3900	57	22
158675	18	2.0	24	0.50	500	<4	2.1	9	11	650	5	29	2000	36	21
158684	19	4.0	36	0.74	710	<4	1.9	100	23	1400	8	15	4200	62	27
158685	18	3.2	23	0.70	590	<4	0.49	11	30	1300	11	18	3300	58	33

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
156857	110	30	1.3	240	140								
156960	150	40	1.8	150	98								
158513	83	32	1.7	150	52								
158514	63	19	1.7	130	75								
158516	100	40	1.7	150	77								
158518	110	95	1.3	130	52								
158523	130	59	1.1	120	55								
158525	88	28	1.4	170	46								
158527	81	31	1.4	170	42								
158530	95	25	1.5	150	120	820							
158532	100	45	1.6	170	65	1800							
158534	100	56	1.5	160	78								
158537	110	23	1.3	140	100								
158539	90	46	1.5	140	83								
158541	130	57	1.4	170	77								
158543	120	46	1.5	160	79	1400							
158549	88	59	1.4	140	75								
158551	300	40	1.4	120	77								
158552	96	17	1.2	140	110								
158555	250	20	1.1	59	41								
158557	62	35	1.5	120	88								
158558	66	34	1.8	110	82								
158561	95	68	1.3	160	53								
158563	62	50	1.1	140	43								
158564	57	47	1.0	140	41	540							
158565	91	49	1.4	130	64								
158567	110	32	1.4	100	49								
158568	64	33	1.3	150	59								
158576	75	29	1.2	140	78								
158577	86	66	1.6	170	74								
158581	83	71	1.8	170	70								
158583	86	66	1.4	140	86								
158586	78	60	1.3	170	50								
158589	77	33	1.0	180	70								
158594	92	18	0.87	130	41								
158600	86	30	1.5	140	70								
158617	130	35	1.7	150	71								
158622	60	47	1.7	190	84								
158633	75	34	2.1	150	92								
158635	76	42	1.8	150	94								
158636	63	32	2.1	160	69								
158641	57	19	1.8	200	46								
158646	77	24	2.1	160	72								
158648	89	41	2.1	160	88								
158658	80	83	1.6	200	110								
158659	81	75	1.9	180	81								
158661	110	44	1.6	140	70								
158663	110	60	1.8	170	99								
158665	93	41	1.9	150	89								
158667	94	37	1.6	160	85								
158668	100	36	1.9	160	80								
158670	99	51	1.6	150	110								
158675	77	37	1.5	160	81	4300							
158684	120	22	1.6	140	160								
158685	56	46	3.0	250	110								

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 1 OF 3

OR SAMPLE NUMBER	D. D. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
158686	40-	41.873	-113.422	-3-12-	3.0	3.3	0.92	<2	5.5	23	710	1	0.80	7	38
158687	40-	41.880	-113.451	-3-15-	22.	22.	1.0	<2	6.1	12	670	3	0.87	8	48
158688	40-	41.878	-113.453	-3-15-	100.	99.	1.0	<2	4.8	24	650	2	1.0	6	34
158692	40-	41.687	-113.787	-3-15-	15.	16.	0.92	<2	6.3	12	540	3	2.1	15	66
158693	40-	41.689	-113.787	-3-15-	14.	15.	0.95	<2	7.5	10	540	3	2.2	18	89
158694	40-	41.688	-113.791	-3-12-	13.	15.	0.88	<2	5.9	<10	540	2	2.1	13	74
158696	40-	42.036	-113.637	-3- -	2.8	3.5	0.81	<2	6.4	20	820	2	2.8	7	50
158697	40-	42.012	-113.643	-3- -	2.7	4.4	0.61	<2	7.0	12	740	2	2.1	6	37
158699	40-	41.968	-113.644	-3- -	8.1	12.	0.67	<2	6.8	15	730	2	2.1	7	37
158718	40-	41.812	-113.587	-3-12-	2.8	3.6	0.78	<2	4.6	12	470	1	4.3	8	70
158720	40-	41.839	-113.660	-3-15-	2.7	3.1	0.86	<2	8.0	<10	890	<1	1.3	8	64
158732	40-	41.896	-113.200	-3-12-	2.7	4.5	0.60	<2	6.3	<10	620	2	2.6	7	56
158735	40-	41.938	-113.267	-3-12-	2.8	3.8	0.73	<2	5.4	33	750	1	1.6	8	44
158737	40-	41.952	-113.265	-3-12-	1.6	3.2	0.50	<2	7.5	11	700	3	1.6	12	62
158739	40-	41.937	-113.281	-3-15-	2.4	5.0	0.48	<2	7.2	18	910	3	1.3	10	51
158742	40-	41.957	-113.269	-3-15-	4.6	5.8	0.79	<2	6.6	10	590	2	1.6	16	100

TABLE B-III. Analyses of sediment samples

12-a

RAFT RIVER - SEDIMENT

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
158686	17	2.3	20	0.52	1400	<4	1.0	4	35	430	6	9	2300	82	17
158687	25	3.1	38	0.77	680	<4	1.5	44	25	1300	8	15	2700	60	24
158688	28	2.1	45	0.65	670	<4	0.72	8	16	1100	6	12	2000	49	30
158692	74	4.2	42	1.2	570	<4	1.3	14	33	970	12	18	4200	100	21
158693	92	5.0	43	1.3	700	<4	1.4	11	57	780	16	13	4800	120	23
158694	37	3.6	35	1.0	1100	<4	1.4	16	34	1000	10	18	3400	78	21
158696	20	2.9	38	1.2	500	<4	1.2	27	33	860	8	9	3300	67	21
158697	14	2.2	27	0.74	480	<4	1.8	10	28	700	6	18	2900	52	19
158699	14	2.2	25	0.74	480	<4	1.7	11	28	700	7	23	2800	52	19
158716	25	2.4	26	1.7	370	<4	0.71	5	39	920	7	7	2500	64	14
158720	<2	3.0	47	1.0	1000	<4	0.84	<4	35	960	1	<2	2700	71	23
158732	13	2.6	30	0.79	440	<4	1.0	9	29	730	12	22	3800	76	27
158735	19	2.2	25	0.91	290	<4	0.85	5	35	510	7	8	2200	92	16
158737	26	3.9	34	1.2	770	<4	1.3	23	41	1200	11	15	5100	87	26
158739	19	4.0	34	0.85	690	<4	0.42	11	32	3500	12	15	3400	64	56
158742	36	4.2	33	1.5	910	<4	1.3	4	61	630	13	12	4600	110	18

TABLE B-III. Analyses of sediment samples

RAFT RIVER - SEDIMENT

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TDT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)
158686	86	77	1.5	180	49								
158687	120	34	1.3	130	93								
158688	94	54	1.3	150	55								
158692	100	44	1.3	140	58								
158693	110	36	1.4	150	50								
158694	98	33	1.2	130	71								
158696	86	75	1.7	230	78								
158697	63	64	1.6	220	82								
158699	63	64	1.5	220	89								
158718	62	33	1.5	150	36								
158720	100	31	2.1	180	<10								
158732	59	37	1.5	230	120								
158735	82	79	1.3	180	48								
158737	83	38	1.7	200	95								
158739	54	35	3.4	250	130								
158742	83	33	1.4	170	48								

TABLE B-III. Analyses of sediment samples

12-c

SAMPLE NUMBER	GEO. CODE
154423	QAL
154424	QAL
154425	PEUN
154426	QO
154427	QAL
154428	OP
154429	PESS
154430	PESS
154431	PEY
154432	EMP
154433	EMP
154434	PEY
154435	PEUN
154436	PEY
154437	PEUN
154438	QO
154441	PEE
154442	PEE
154443	PEE
154444	PEE
154445	PEE
154446	PEUN
154447	PEE
154448	PEE
154449	PEE
154450	PEE
154451	EMP
154452	OP
154453	PEOLS
154454	OP
154458	PETR
154459	PETR
154460	PETR
154461	QU
154462	XE
154463	XUN
154464	ZHS
154465	XUN
154466	XE
154467	WG
154468	XE
154469	XE
154470	XUN
154471	PO
154472	MM
154474	CD
154475	PEo
154476	QF
154477	PEA
154479	PEA
154480	PEA
154482	PEA
154484	PEA
154486	QAG
154487	PEE
154488	PEE
154489	PEE
154491	XE
154493	XE
154494	XUN
154495	XE
154496	XE
154497	QU
154515	PEE
154518	QO
154519	PEE
154521	QAL
154528	QAL
154531	PESS
154540	PEA
154543	PEA
154545	QAG
154548	QAG
154549	PEA
154556	PEA
154560	PEUN
154562	QO
154565	PEE
154567	PEE
154569	PEA
154570	PEE
154575	PEA
154577	PEA
154578	PEA
154580	PEA
154582	PEA
154583	PEA
154584	PEA
154586	PEA
154591	QAL
154592	PEUN

SAMPLE NUMBER	GEO. CODE
154593	PEE
154594	PEE
154598	QAS
154603	ECB
154605	QAS
154606	QAS
154608	XUN
154611	XE
154613	XUN
154615	PEE
154618	PEE
154619	PEE
154620	QO
154622	QO
154624	PO
154626	PEA
154628	PESS
154631	PEA
154632	PEA
154633	PEA
154634	QO
154636	PETR
154637	PEE
154638	QO
154639	QO
154640	QO
154641	QO
154642	QO
154643	QO
154644	QO
154645	QO
154646	QO
154647	QO
154648	PEA
154649	PEA
154650	QO
154651	PEE
154652	PEE
154653	PEE
154654	PEE
154655	QO
154656	PEE
154657	PEE
154658	QO
154659	PEE
154660	PEE
154661	ECB
154662	OP
154663	OP
154664	PO
154665	PO
154666	QO
154667	PO
154668	QO
154669	QO
154670	PEE
154671	PEA
154674	PEE
154675	PEE
154676	PEA
154677	PEA
154678	PEE
154679	PEE
154680	OP
154692	PEA
154694	PEA
154697	PEOS
154699	PETR
154701	PETR
154703	PEE
154705	OP
154707	PEE
154709	QO
154711	QO
154714	PEE
154716	PEE
154730	QO
154731	QO
154732	QO
154735	PEE
154736	PEE
154738	PEE
154740	PEE
154742	PEE
154744	PEE
154747	PEOS
154750	PEOS
154751	PEOS
154753	PEE
154754	PEE
154755	PEE

SAMPLE NUMBER	GEO. CODE
154757	PEE
154758	PEE
154759	PEE
154760	PEE
154762	PEE
154763	PEE
154764	PEE
154765	PEE
154767	PEE
154769	PEOS
154770	PEMI
154773	PEMI
154775	PEOS
154777	PEOS
154779	PEA
154780	PEE
154781	PEY
154785	PEE
154787	QO
154789	PEA
154792	ZHS
154794	PO
154795	PO
154796	PO
154798	QU
154801	XUN
154802	XUN
154804	ECB
154805	ECB
154806	QU
154808	QAL
154812	QF
154814	XE
154816	PO
154818	OP
154820	ECB
154821	OP
154825	WG
154827	WG
154830	PEE
154832	PEE
154834	PEE
154837	XUN
154838	XUN
154839	XE
154840	XE
154842	XE
154843	XE
154844	WG
154849	XE
154850	XE
154851	QU
154853	QU
154856	PEA
154857	PEA
154861	WG
154862	PEE
154864	PEE
154866	PEE
154868	PEE
154870	XE
154871	WG
154872	XE
154873	PEE
154874	PEE
154875	WG
154876	WG
154877	WG
154879	PEA
154880	PEA
154882	PEA
154883	WG
154885	PEE
154886	PEE
154892	PEE
154894	TAP
154895	PEE
154896	PEE
154897	PEE
154898	QF
154899	TV
154900	TAP
154901	WG
154904	QF
154905	QF
154906	QF
154907	TSL
154909	TSL
154911	PETR
154912	PETR
154914	PEA

SAMPLE NUMBER	GEO. CODE
154916	PEA
154920	PEA
154922	PEA
154923	QAS
154924	QAS
154925	XUN
154928	XE
154930	WG
156363	PO
156364	ENS
156365	PEE
156366	MM
156367	MM
156368	QU
156369	EMP
156370	PO
156371	PO
156372	EMP
156373	QAL
156374	QAL
156375	QAL
156376	QAL
156377	QAL
156378	QAL
156379	XE
156380	XE
156381	QU
156382	WG
156383	WG
156384	PEE
156385	PEE
156386	QF
156387	PEE
156388	PEE
156389	WG
156391	QF
156392	PEE
156393	PEE
156394	WG
156395	WG
156396	TAP
156397	TAP
156398	PEE
156399	PEE
156400	WG
156402	ENS
156403	WG
156404	WG
156406	EY
156410	QF
156417	PEE
156418	TAP
156419	TAP
156421	TAP
156422	TAP
156423	TAP
156424	WG
156427	TV
156428	QF
156429	ENS
156430	QF
156431	ES
156432	MM
156433	MM
156434	MM
156435	MM
156436	MM
156437	QF
156438	QF
156439	GN
156440	GN
156441	QF
156442	QF
156443	GN
156445	TVG
156446	MM
156447	TVG
156448	QAL
156450	QF
156451	TVG
156453	QF
156456	MM
156457	MM
156458	ECB
156459	EY
156460	WG
156462	WG
156464	ENS
156465	ENS
156466	EMP
156469	ECB

SAMPLE NUMBER	GEO. CODE
156470	PEY
156473	PEY
156482	DC
156483	DC
156485	DC
156487	DC
156488	DC
156494	XE
156504	QF
156517	PEE
156518	PEE
156519	QF
156520	QF
156521	TV
156523	QF
156424	QU
156525	ZHS
156526	ZHS
156527	ZHS
156528	OP
156529	ZHS
156532	WG
156535	WG
156537	ES
156538	ES
156539	ENS
156540	ENS
156541	ES
156546	WG
156549	PEE
156552	WG
156554	WG
156556	TV
156557	PEE
156562	XUN
156564	XE
156568	XUN
156569	QU
156573	QF
156575	PEE
156576	PEE
156578	QF
156579	QF
156580	PEA
156581	PEA
156583	PEA
156584	WG
156586	PEA
156589	PEE
156590	PEUN
156591	PEUN
156592	PEUN
156593	PEUN
156598	PEUN
156603	QO
156605	PEY
156609	QO
156613	ECB
156614	ECB
156616	ECB
156622	PEY
156624	PEUN
156628	PEUN
156630	PEY
156634	ECB
156636	PEE
156637	PEE
156640	PO
156644	PEUN
156645	PEUN
156647	PEUN
156650	PEUN
156651	PEUN
156653	PEUN
156654	PESS
156655	TS
156658	PESS
156659	ECB
156661	OP
156662	OP
156663	OP
156665	ECB
156666	QO
156672	PESS
156673	PEUN
156676	PEUN
156678	PEUN
156679	PEUN
156681	PEUN
156682	PEUN
156683	PEUN

SAMPLE NUMBER	GEO. CODE
156688	TSL
156689	ECB
156691	ECB
156693	TSL
156694	QAS
156697	PEA
156701	PEA
156702	PEA
156704	PEE
156705	PEE
156706	PEE
156708	PEE
156712	WG
156714	WG
156715	WG
156716	WG
156717	WG
156721	WG
156722	WG
156726	OP
156727	QU
156729	QU
156734	XUN
156735	XE
156743	GN
156745	QF
156747	QF
156749	QF
156750	QF
156751	QF
156752	ENS
156754	MM
156756	MM
156758	MM
156760	TVG
156761	GN
156763	MM
156765	MM
156767	EY
156768	ECB
156769	GN
156771	XUN
156772	XE
156773	WG
156774	XUN
156775	XE
156777	XE
156778	XUN
156779	XUN
156781	XUN
156782	XUN
156785	PEA
156787	XE
156789	XE
156790	WG
156794	PETR
156796	TAP
156798	PEE
156801	WG
156802	TAP
156803	WG
156804	WG
156805	WG
156806	QF
156810	QAS
156818	XUN
156819	XE
156821	XE
156825	XE
156827	TSL
156828	TSL
156830	TSL
156832	TSL
156834	PEE
156835	PEE
156836	PEE
156837	PEE
156839	ECB
156842	WG
156843	XUN
156844	XE
156845	XE
156846	XE
156847	WG
156848	WG
156851	WG
156852	WG
156853	WG
156854	WG
156856	WG
156857	WG

SAMPLE NUMBER	GEO. CODE
156860	PEE
158513	PEA
158514	PEA
158516	TSL
158518	TSL
158523	QAS
158525	PEUN
158527	PEUN
158530	PEE
158532	PEA
158534	PESS
158537	PESS
158539	PESS
158541	PESS
158543	ECB
158549	PEE
158551	PEE
158552	PEE
158553	ECB
158555	PEE
158557	PEA
158558	PEA
158561	PEE
158563	PEE
158564	PEE
158565	QO
158567	PEAD
158568	PEE
158576	QO
158577	PESS
158581	PEE
158583	PEA
158586	ECB
158589	PEE
158594	PO
158599	QAG
158600	PEA
158602	PEA
158604	PEA
158606	PEA
158608	PEA
158610	QAG
158612	PEA
158614	PEA
158617	PEA
158622	PEA
158626	ECB
158629	ECB
158633	PEE
158636	PEE
158641	PEA
158646	PEA
158648	PEA
158658	QAS
158659	ECB
158661	ECB
158663	PESS
158665	PESS
158667	PEA
158668	PEA
158670	PEE
158675	PEA
158679	PEA
158684	PEA
158685	PEA
158686	PEA
158687	PEA
158688	PEA
158693	PEA
158694	PEA
158696	QAL
158697	QAL
158699	QAL
158718	QAL
158720	OP
158732	PEOS
158735	PEOS
158737	PETR
158739	PEOS
158742	QAL
158635	PEE

TABLE B-IV. Geologic unit code index for sediment samples

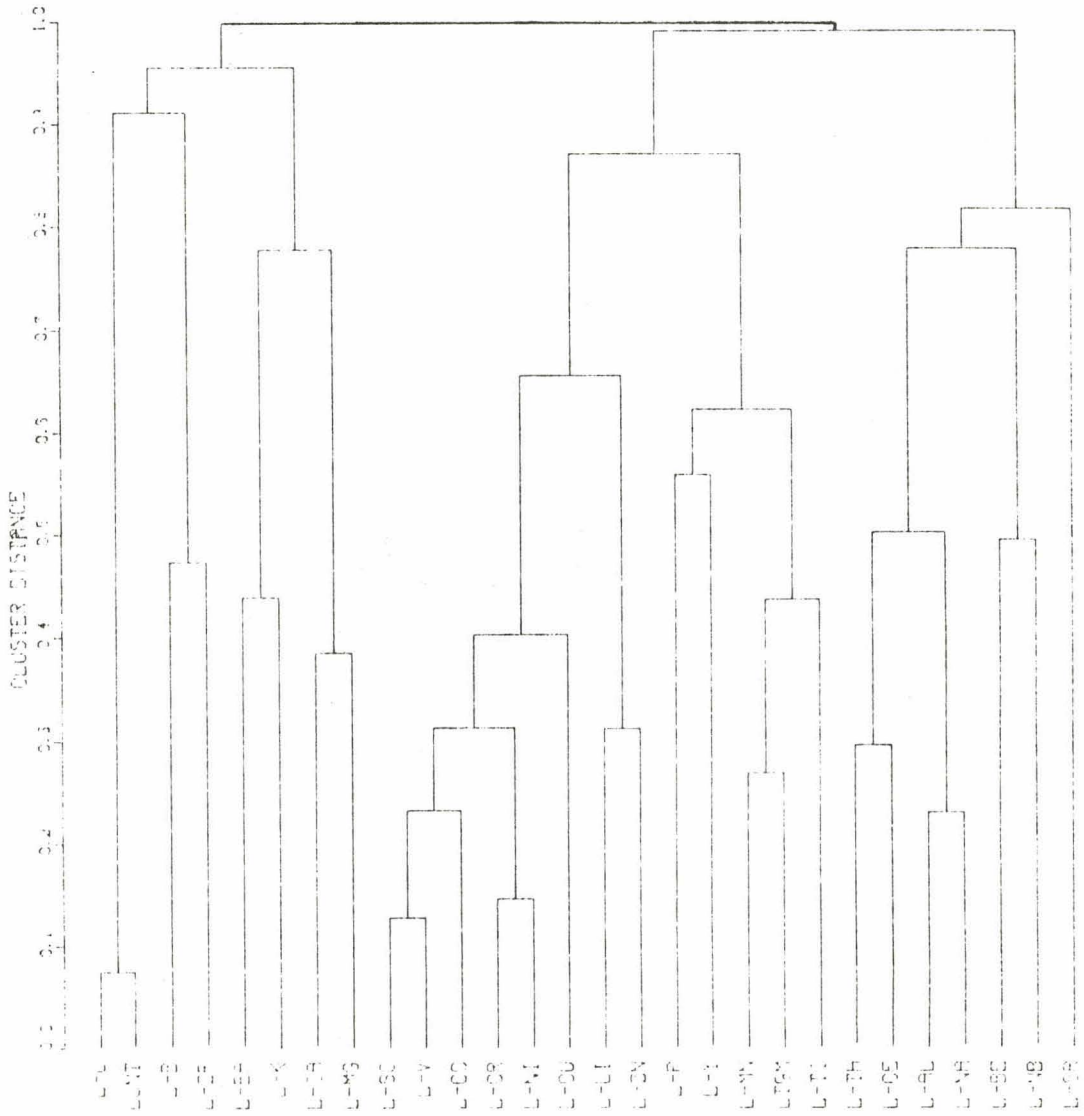


Figure B-1. Cluster analysis (dendrogram) of correlation matrix for stream sediment samples

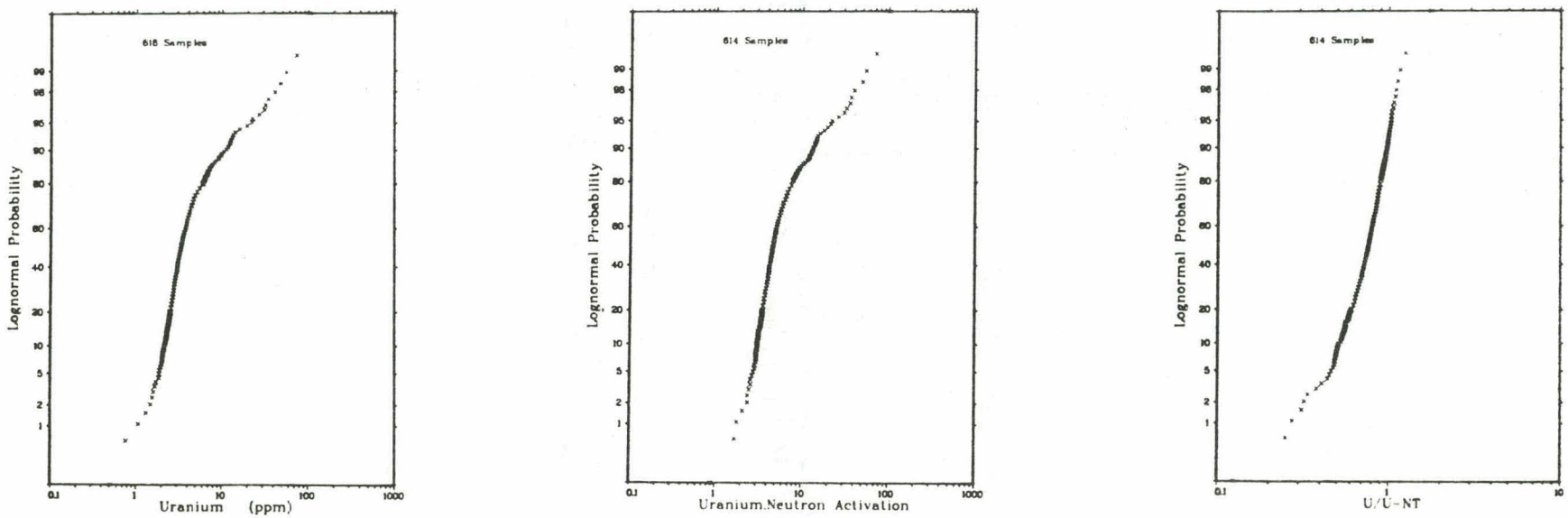


Figure B-2a. Logprobability plots of uranium (fluorimetric) uranium (neutron activation) and U/U-NT values in sediment samples.

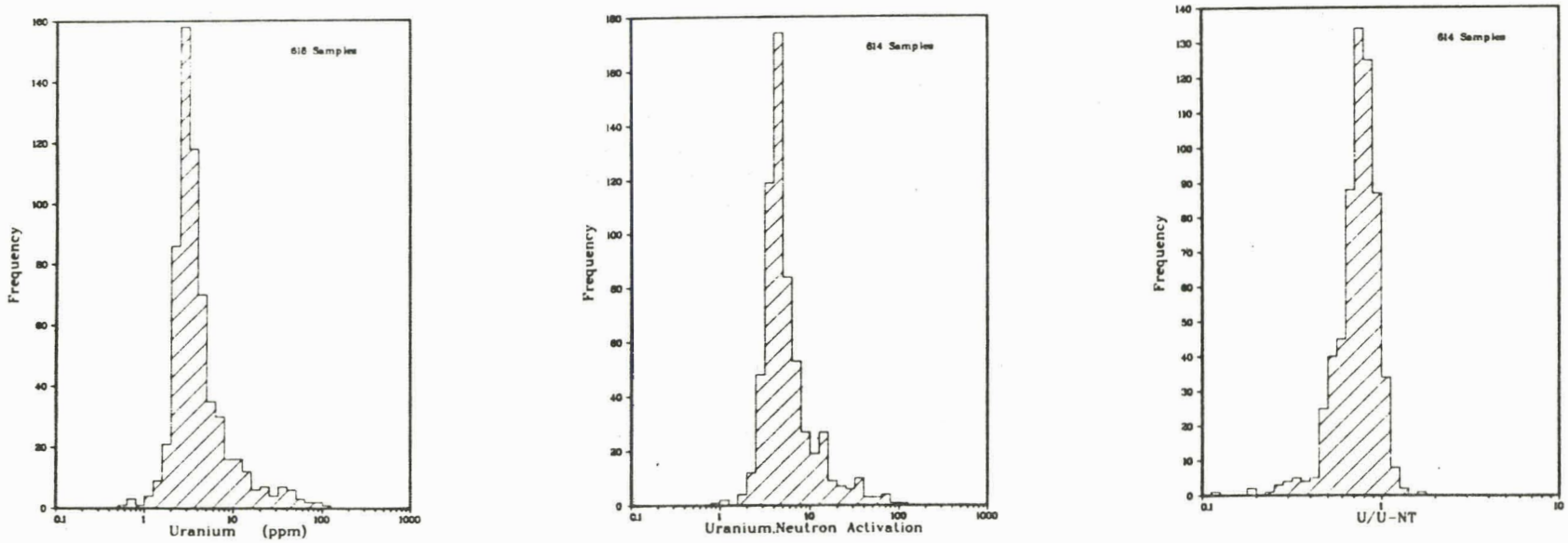


Figure B-2b. Logfrequency plots of uranium (fluorimetric) uranium (neutron activation) and U/U-NT values in sediment samples

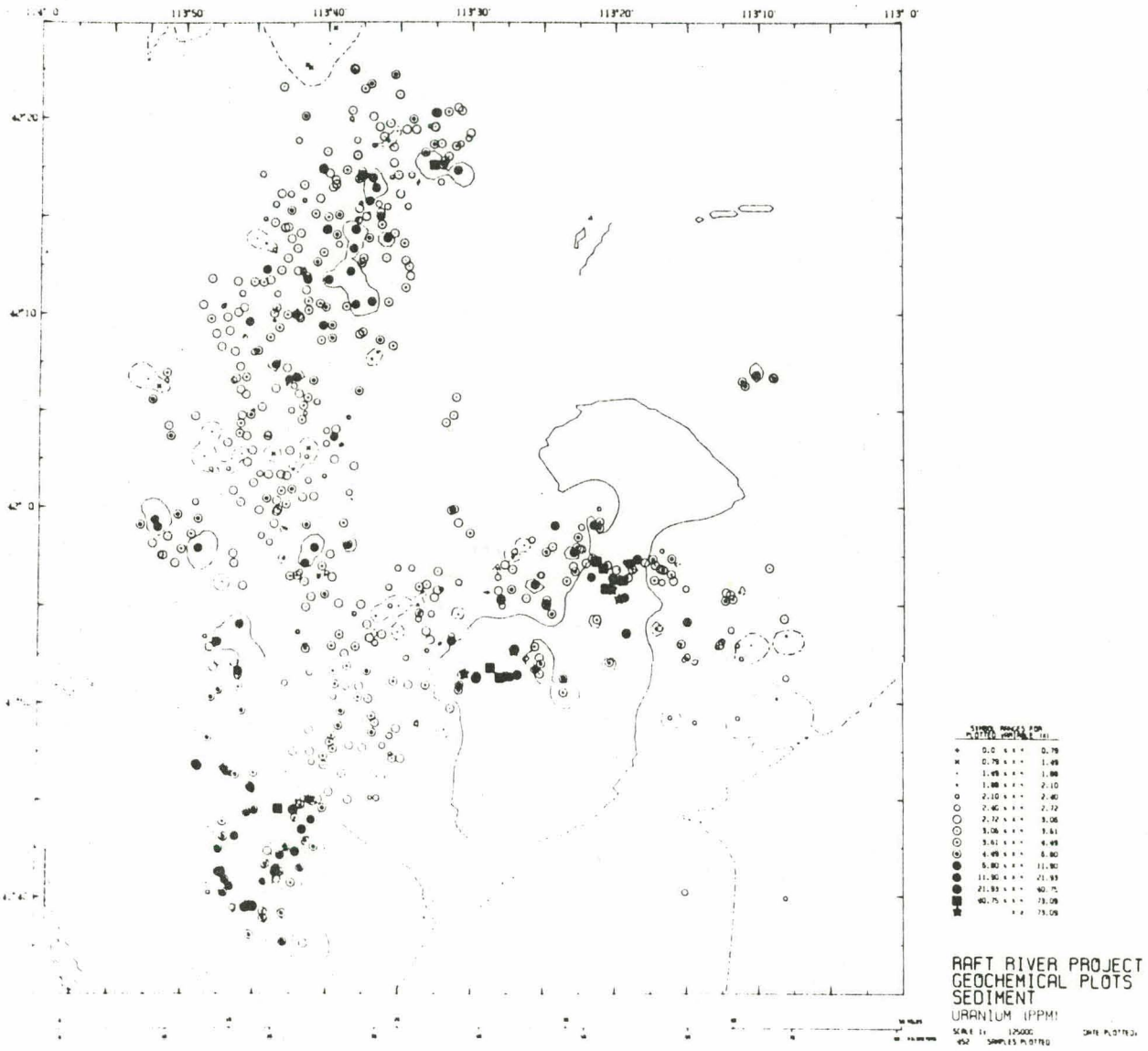


Figure B-3. Areal distribution of uranium (fluorimetric) concentrations in sediment samples

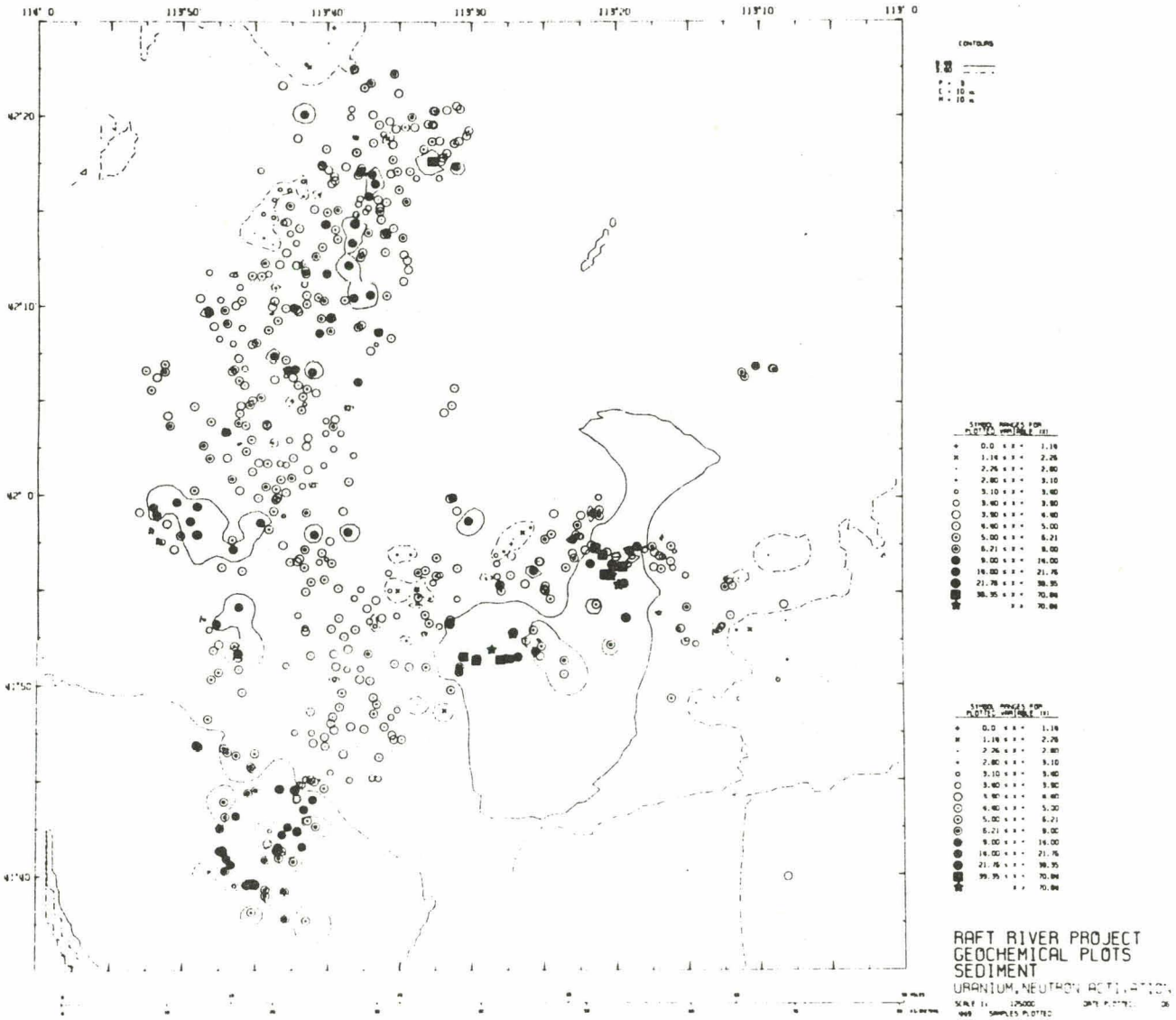


Figure B-4. Areal distribution of uranium,(neutron activation) concentrations in sediment samples

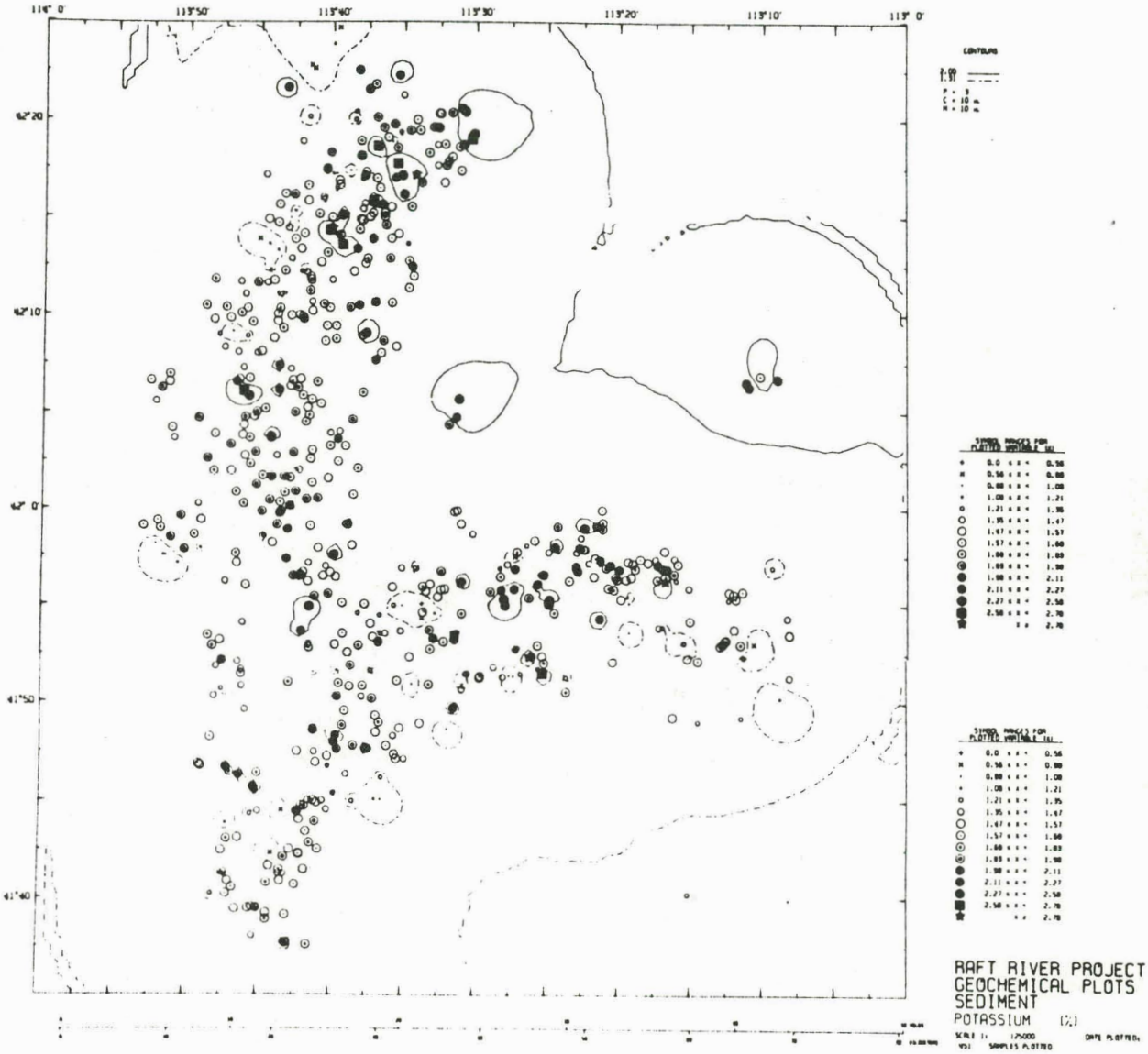


Figure B-5. Areal distribution of potassium concentrations in sediment samples

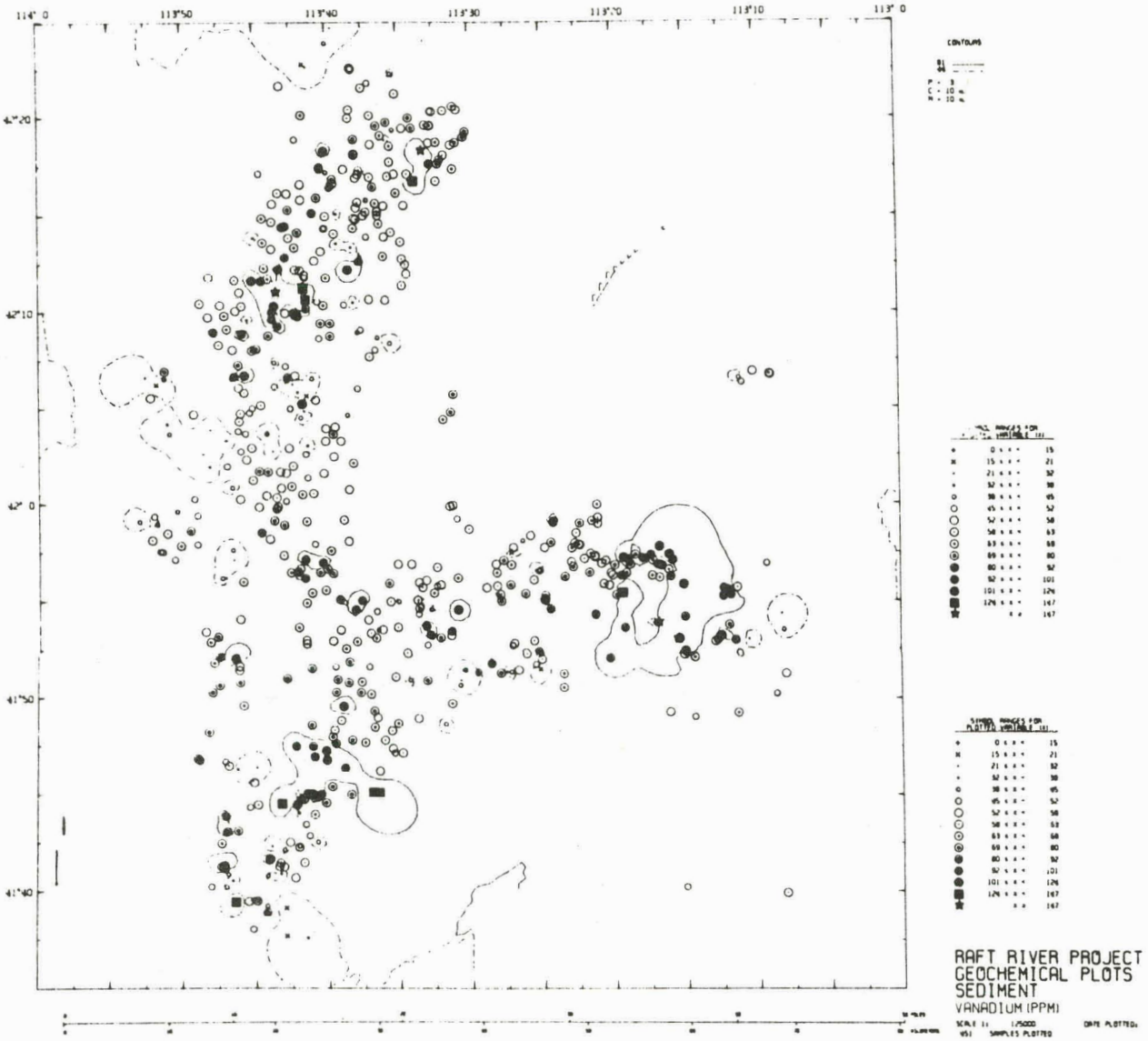


Figure B-6. Areal distribution of vanadium concentrations in sediment samples

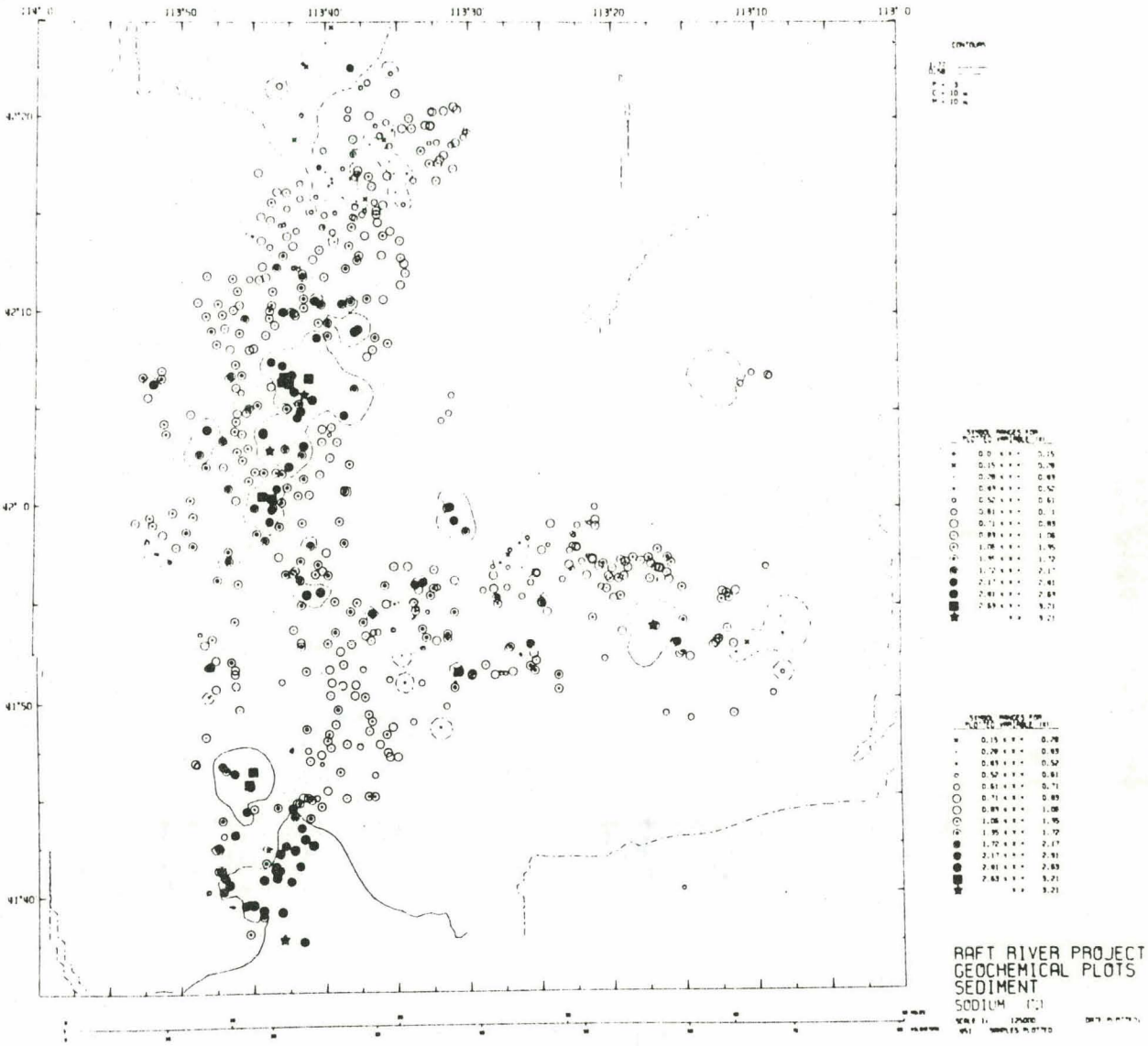


Figure B-7. Areal distribution of sodium concentrations in sediment samples

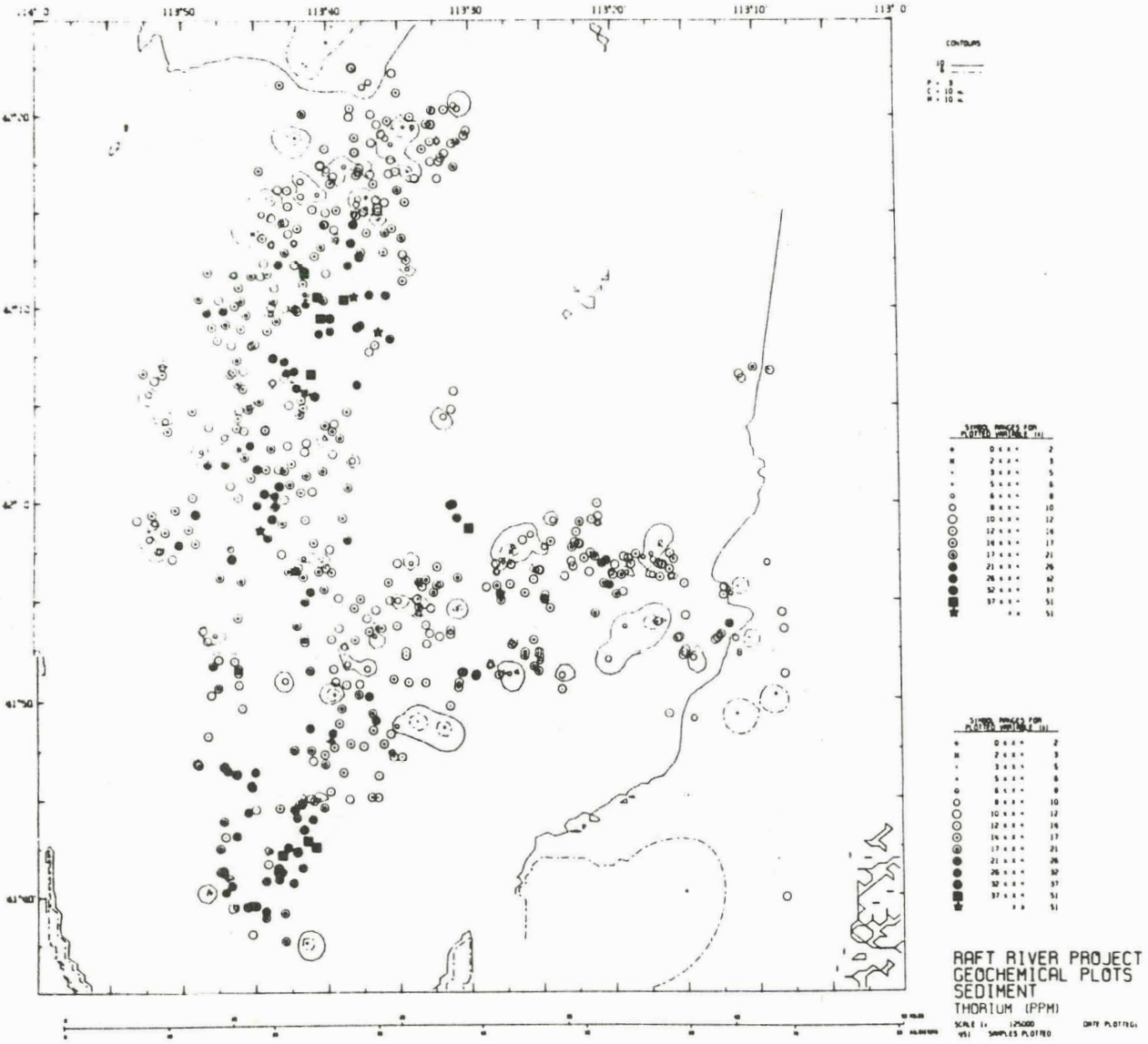


Figure B-8. Areal distribution of thorium concentrations in sediment samples

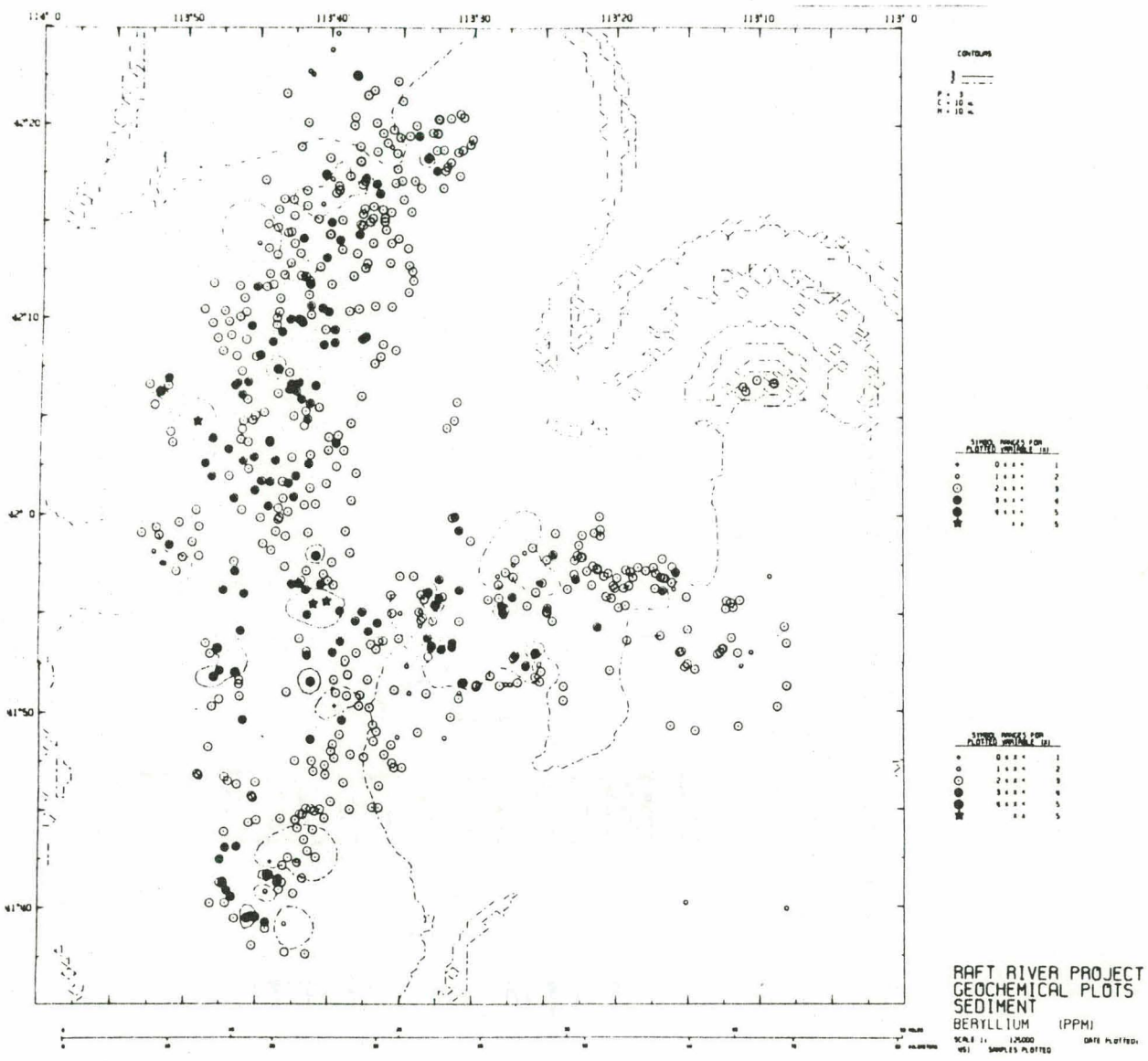


Figure B-9. Areal distribution of beryllium concentrations in sediment samples

RAFT RIVER - ROCK

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	LN TRANSFORMATION ROBUST MEAN	LN TRANSFORMATION ROBUST S. D.
U	252	11	<0.25	<0.25	13.64	1.91	1.38	0.88	1.889	0.989	0.31	0.82	0.23	0.92
U-NT	264			0.0	26.50	2.85	2.20	0.68	2.857	1.001				
U/TU	261			0.10	2.17	0.70	0.66	0.62	0.285	0.406	-0.44	0.44	-0.42	0.47
AG	1	262	<2	<2	19	19	<2	<2	0.0	0.0	2.94	0.0		
AL	261	2	<0.05	<0.05	11.56	3.93	3.08	0.59	3.107	0.790	0.84	1.20	0.88	1.05
B	49	214	<10	<10	47	18	<10	<10	9.5	0.5	2.80	0.45		
BA	263			15	4878	514	309	39	556.4	1.1	5.58	1.29	5.60	1.19
BE	147	116	<1	<1	10	2	<1	<1	1.6	0.7	0.61	0.61		
CA	177	86	<0.05	<0.05	6.18	0.58	0.16	<0.05	0.746	1.278	-1.06	1.06	-1.91	1.61
CO	78	185	<4	<4	67	11	<4	<4	9.8	0.8	2.23	0.67		
CR	263			1	300	42	18	11	56.7	1.3	3.11	1.12	3.11	1.19
CU	241	22	<2	<2	121	11	5	3	16.8	1.5	1.90	0.94	1.66	1.23
FE	262	1	<0.05	<0.05	17.90	1.69	0.60	0.22	2.273	1.342	-0.30	1.34	-0.31	1.24
LI	255	8	<1	<1	115	11	7	<1	13.7	1.1	1.81	1.25	1.80	1.34
MG	187	76	<0.05	<0.05	3.56	0.53	0.12	<0.05	0.696	1.301	-1.29	1.15	-2.09	1.74
MN	262	1	<4	<4	1974	192	64	20	294.6	1.5	4.24	1.52	4.21	1.44
MO	6	257	<4	<4	17	6	<4	<4	5.1	0.8	1.73	0.56		
NA	147	116	<0.05	<0.05	4.36	1.34	0.08	0.06	1.078	0.807	-0.37	1.41		
NB	99	164	<4	<4	201	21	<4	<4	41.2	1.9	2.43	0.91		
NI	245	18	<2	<2	133	14	5	3	22.1	1.5	2.05	1.05	1.80	1.39
P	262	1	<5	<5	4793	464	210	51	664.1	1.4	5.36	1.30	5.35	1.31
SC	232	31	<1	<1	49	5	2	<1	6.5	1.2	1.14	1.02		
TH	235	28	<2	<2	231	19	10	<2	25.0	1.3	2.45	1.00	2.26	1.14
TI	262	1	<10	<10	13734	1524	743	62	1909.6	1.3	6.54	1.38	6.55	1.32
V	252	11	<2	<2	370	35	11	7	52.8	1.5	2.80	1.21	2.68	1.28
Y	244	19	<1	<1	75	8	4	<1	10.4	1.2	1.55	1.15	1.44	1.34
ZN	259	4	<2	<2	283	30	12	3	38.9	1.3	2.68	1.25	2.63	1.33
ZR	142	121	<2	<2	282	6	<2	<2	24.9	3.7	1.20	0.76		
K	261	2	<0.02	<0.02	4.71	1.51	1.27	0.20	1.188	0.785	-0.04	1.12	-0.00	1.05
SR	261	2	<1	<1	741	73	45	9	84.3	1.2	3.61	1.30	3.61	1.29
CE	228	35	<10	<10	438	67	41	15	59.0	0.9	3.87	0.85	3.65	1.00
TGAM	64			0	12000	2947	1823	0	2949.1	1.0				
TOT	64			553	19535	9651	8788	10153	4314.5	0.4	9.00	0.77	9.08	1.05
EK	112			0.0	17.4	1.8	0.7	0.2	2.65	1.45				
CPK	65			2	313	91	58	34	77.7	0.8	4.08	1.07	4.14	1.01
CU	241	22	<2	<2	121	11	5	3	16.8	1.5	1.90	0.94	1.66	1.23
CPU	65			1	175	36	27	15	30.6	0.8	3.25	0.94	3.30	0.93
ETH	112			0.9	297.0	24.7	15.3	6.7	34.76	1.41	2.76	0.91	2.75	0.88
CPTH	65			0	194	28	18	8	30.2	1.1	2.89	1.04	2.93	0.96
TH/U	261			0.42	26.88	6.42	5.00	2.10	4.836	0.753	1.55	0.84	1.57	0.83

Table C-I. Summary statistics for all rock samples

RAFT RIVER PROJECT - ROCKS

FOR GEOLOGIC CODES: CC80

ELEMENT	NO. SAMPLES ANALYZED: MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION: MEAN	LN TRANSFORMATION: S. D.	ANTILOG: MEAN	ANTILOG: S. D.
U	16	2	<0.25	<0.25	3.92	1.38	1.00	1.53	0.984	0.714	0.05	0.71		
U-NT	16			0.0	4.90	1.72	1.30	1.55	1.329	0.773				
U/TU	15			0.25	1.30	0.71	0.65	0.80	0.296	0.416	-0.43	0.46		
AG	0	18	<2	<2	<2		<2	<2						
AL	16	2	<0.05	<0.05	24.00	5.32	2.03	7.29	5.689	1.070	1.23	1.00		
B	2	1	<4	<4	46	28	<10	<10	24.7	0.9	3.11	1.01		
		15	<10											
BA	18			15	2258	414	214	32	525.3	1.3	5.26	1.46		
BE	6	12	<1	<1	10	3	<1	<1	3.5	1.1	0.73	0.95		
CA	12	6	<0.05	<0.05	18.50	1.97	0.07	<0.05	5.228	2.656	-1.02	1.70		
CO	3	1	<2	<2	19	11	<4	<4	7.0	0.6	2.27	0.63		
		14	<4											
CR	17	1	<4	<4	230	36	14	14	63.9	1.8	2.78	1.15		
CU	16	2	<2	<2	46	9	4	<2	12.5	1.3	1.75	1.00		
FE	16	1	<0.05	<0.05	10.00	0.98	0.40	<10.00	1.227	1.255	-0.29	1.17		
		1	<10.00											
LI	18			1	45	10	5	4	11.9	1.1	1.79	1.17		
MG	12	6	<0.05	<0.05	4.70	0.71	0.96	<0.05	1.370	1.918	-1.47	1.43		
MN	16	1	<2	<2	553	131	29	6	152.1	1.2	4.08	1.45		
		1	<4											
MO	1	17	<4	<4	4	4	<4	<4	0.0	0.0	1.39	0.0		
NA	11	7	<0.05	<0.05	5.50	1.75	0.22	0.07	1.621	0.928	-0.02	1.33		
NB	7	11	<4	<4	14	8	<4	<4	4.0	0.5	2.07	0.47		
NI	14	3	<2	<2	89	15	<4	<4	24.0	1.5	2.06	1.12		
		1	<4											
P	16	1	<5	<5	1293	222	107	<40	318.8	1.4	4.77	1.19		
		1	<40											
SC	15	3	<1	<1	15	3	<1	<1	4.6	1.4	0.69	0.94		
TH	15	2	<2	<2	24	4	4	<5	7.4	0.9	1.77	0.86		
		1	<5											
TI	16	1	<2	<2	3177	808	401	22	880.5	1.1	6.04	1.45		
		1	<10											
V	13	4	<2	<2	255	40	6	6	62.6	2.0	2.61	1.29		
		1	<4											
Y	15	3	<1	<1	12	4	2	<1	3.3	0.8	1.07	0.84		
ZN	16	2	<2	<2	104	23	9	3	33.6	1.2	2.73	1.19		
ZR	6	12	<2	<2	20	5	<2	<2	7.3	1.5	1.06	0.94		
K	17	1	<0.02	<0.02	2.74	1.30	1.13	1.81	0.781	0.599	-0.11	1.22		
SR	16	2	<1	<1	301	66	25	12	78.4	1.2	3.53	1.27		
CE	12	5	<10	<10	72	30	18	<30	17.7	0.6	3.36	0.45		
		1	<30											

Table C-II. Summary statistics for Quartzite of Clarks Basin

RAFT RIVER PROJECT — ROCKS

FOR GEOLOGIC CODES: PCYG PCYS PCEQ PCEU XEQZ CYCU PCYG

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	BWEST MEAN	BWEST S. D.
U	98	7	<0.25	<0.25	5.80	1.09	0.70	0.63	1.168	1.071	-0.22	0.72	-0.36	0.84
U-NT	105			0.40	8.70	1.50	0.90	0.61	1.723	1.150	0.07	0.71	0.02	0.65
U/TU	105			0.10	1.67	0.73	0.67	0.64	0.305	0.419	-0.42	0.49	-0.39	0.51
AG	0	105	<2	<2	<2		<2	<2						
AL	105			0.14	8.89	1.25	0.84	0.49	1.535	1.232	-0.19	0.65	-0.22	0.64
B	14	91	<10	<10	39	15	<10	<10	7.9	0.5	2.63	0.36		
BA	105			19	1996	165	83	39	250.6	1.5	4.59	0.93	4.56	0.95
BE	20	85	<1	<1	7	1	<1	<1	1.4	0.9	0.24	0.54		
CA	38	67	<0.05	<0.05	1.59	0.23	<0.05	<0.05	0.324	1.388	-1.57	0.93		
CO	7	98	<4	<4	21	9	<4	<4	7.7	0.8	2.03	0.77		
CR	105			1	300	27	14	11	40.2	1.5	2.87	0.62	2.63	0.63
CU	100	5	<2	<2	121	8	4	3	16.0	1.9	1.64	0.77	1.50	0.74
FE	105			0.05	7.28	0.52	0.24	0.16	1.098	2.111	-1.28	0.90	-1.56	0.66
LI	97	8	<1	<1	33	3	2	<1	5.4	1.5	0.61	0.69		
MG	48	57	<0.05	<0.05	1.39	0.15	<0.05	<0.05	0.221	1.499	-2.29	0.71		
MN	105			4	974	59	18	9	149.5	2.5	3.12	1.13	3.03	1.21
MO	1	104	<4	<4	4	4	<4	<4	0.0	0.0	1.39	0.0		
NA	15	90	<0.05	<0.05	4.36	0.83	<0.05	<0.05	1.491	1.798	-1.64	1.67		
NB	4	101	<4	<4	201	58	<4	<4	95.2	1.6	3.09	1.48		
NI	98	7	<2	<2	54	5	4	3	6.4	1.1	1.52	0.61	1.41	0.74
P	105			15	2077	223	79	29	370.0	1.7	4.59	1.17	4.55	1.20
SC	82	23	<1	<1	18	1	<1	<1	2.4	1.3	0.36	0.62		
TH	83	22	<2	<2	146	12	5	<2	22.7	1.8	1.93	0.97	1.50	1.28
TI	105			61	6996	515	238	101	936.7	1.8	5.62	1.00	5.56	0.94
V	103	2	<2	<2	182	11	7	7	20.5	1.7	2.04	0.60	1.96	0.82
Y	90	15	<1	<1	38	3	<1	<1	5.5	1.7	0.67	0.87		
ZN	103	2	<2	<2	118	9	5	3	17.1	1.9	1.70	0.81	1.58	0.82
ZR	37	68	<2	<2	12	3	<2	<2	2.5	0.8	1.01	0.51		
K	105			0.04	2.67	0.59	0.42	0.16	0.529	0.896	-0.90	0.89	-0.88	0.93
SR	105			2	286	27	13	8	43.5	1.6	2.68	1.05	2.64	1.14
CE	84	21	<10	<10	293	37	19	15	41.3	1.1	3.32	0.72	2.95	0.96

Table C-III. Summary statistics for Precambrian X (?) quartzites, Yost and Elba

RAFT RIVER PROJECT - ROCKS

FOR GEOLOGIC CONSTRUCTED ROPE

ELEMENT	93. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	BOXCOX MEAN	BOXCOX S. D.
U	13			0.58	9.96	3.36	1.74	1.35	3.216	0.923	0.67	0.51		
U-NT	13			0.60	14.90	5.39	2.90	1.79	4.622	0.908	1.23	0.96		
U/TU	13			0.52	0.97	0.71	0.68	0.66	0.126	0.179	-0.36	0.16		
AG	0	13	<2	<2	<2		<2	<2						
AL	13			0.39	6.09	1.60	1.16	1.23	1.477	0.926	0.21	0.65		
B	5	8	<10	<10	22	13	<10	<10	4.7	0.3	2.59	0.29		
BA	13			25	680	204	166	269	170.9	0.8	5.01	0.66		
BE	5	8	<1	<1	1	1	<1	<1	0.0	0.0	0.0	0.0		
CA	8	5	<0.05	<0.05	0.32	0.12	0.05	<0.05	0.088	0.716	-2.28	0.60		
CD	0	13	<4	<4	<4		<4	<4						
CR	13			8	207	74	41	206	76.0	1.0	3.79	1.10		
CU	12	1	<2	<2	7	4	3	3	2.0	0.5	1.32	0.47		
FE	13			0.11	0.94	0.38	0.27	0.54	0.252	0.657	-1.14	0.63		
LI	13			1	7	2	2	2	1.9	0.7	0.61	0.68		
MG	10	3	<0.05	<0.05	0.18	0.10	0.06	0.07	0.046	0.465	-2.42	0.46		
MN	13			5	69	25	17	17	18.1	0.7	3.01	0.69		
MO	0	13	<4	<4	<4		<4	<4						
NA	1	12	<0.05	<0.05	1.98	1.98	<0.05	<0.05	0.0	0.0	0.68	0.0		
NB	2	11	<4	<4	5	4	<4	<4	0.7	0.2	1.50	0.16		
NI	13			2	4	4	4	4	1.7	0.4	1.45	0.38		
P	13			24	1561	306	176	119	398.0	1.3	5.25	0.96		
SC	13			1	3	1	2	2	0.6	0.3	0.51	0.37		
TH	13			4	231	64	43	50	61.8	1.0	3.73	1.07		
TI	13			288	1027	795	753	753	351.8	0.4	6.59	0.44		
V	13			5	29	16	14	23	7.1	0.4	2.72	0.51		
Y	13			1	11	4	3	4	3.4	0.7	1.25	0.76		
ZN	13			2	20	6	5	4	5.4	0.8	1.70	0.69		
ZR	13			2	20	6	4	2	5.2	0.8	1.56	0.74		
K	13			0.16	2.98	0.69	0.64	1.27	0.731	0.826	-0.39	0.77		
SR	13			4	53	16	13	19	12.4	0.7	2.61	0.67		
CE	13			26	184	79	60	56	46.5	0.6	4.22	0.59		

Table C-IV. Summary statistics for Elba conglomerates

RAFT RIVER PROJECT - ALCOA

FOR GEOLOGIC CODES:FCOS FCOS FCON XONS CNS

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	ELCO* DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	ANTILOG MEAN	ANTILOG S. D.
U	48	1	<0.25	<0.25	3.45	1.90	1.39	1.88	0.758	0.395	0.53	0.54	0.54	0.65
U-NT	50			0.10	7.50	3.86	3.60	3.55	1.713	0.444	1.18	0.73	1.26	0.63
U/TU	49			0.16	1.25	0.53	0.51	0.58	0.215	0.406	-0.71	0.40	-0.70	0.41
AG	0	49	<2	<2	<2		<2	<2						
AL	49			0.05	11.56	5.36	6.80	7.17	2.502	0.372	1.69	0.62	1.79	0.54
B	18	31	<10	<10	47	21	<10	<10	10.2	0.5	2.97	0.48		
BA	49			21	1607	804	518	948	353.6	0.4	6.56	0.67	6.62	0.52
BE	46	3	<1	<1	7	2	2	<1	1.5	0.6	0.83	0.58	0.85	0.62
CA	44	5	<0.05	<0.05	2.85	0.48	0.30	0.32	0.479	1.006	-1.06	0.62	-1.26	1.09
CO	35	14	<4	<4	37	9	5	6	6.6	0.7	2.06	0.53	1.75	0.65
CR	49			6	242	53	54	89	43.1	0.7	3.80	0.81	3.81	0.69
CU	41	8	<2	<2	107	15	8	3	18.3	1.1	2.36	0.90	2.08	1.06
FE	49			0.11	17.90	3.67	3.06	2.73	2.998	0.816	1.01	0.67	1.05	0.64
LI	49			1	115	20	15	25	17.8	0.9	2.73	0.82	2.76	0.74
MG	46	1	<0.05	<0.05	3.51	0.72	0.56	0.17	0.609	0.851	-0.62	0.60	-0.65	0.66
MN	49			14	1757	368	220	175	384.5	1.0	5.37	1.14	5.38	1.10
MO	1	48	<4	<4	6	6	<4	<4	0.0	0.0	1.79	0.0		
NA	46	3	<0.05	<0.05	2.76	0.74	0.13	0.11	0.897	1.210	-1.12	1.53	-1.27	1.37
NB	29	20	<4	<4	199	38	7	<4	61.1	1.6	2.81	1.16		
NI	48	1	<2	<2	106	21	17	13	17.4	0.8	2.82	0.75	2.80	0.67
P	49			55	4753	996	773	877	940.1	0.9	6.50	0.96	6.53	1.94
SC	48	1	<1	<1	48	9	9	9	7.2	0.7	2.05	0.78	2.10	0.69
TH	47	2	<2	<2	77	17	15	15	12.7	0.7	2.64	0.66	2.59	0.63
TI	49			21	13734	3363	3154	3715	2415.8	0.7	7.81	1.01	7.89	0.80
V	48	1	<2	<2	370	68	60	62	56.2	0.8	3.96	0.81	3.94	0.96
Y	48	1	<1	<1	48	14	11	13	12.1	0.8	2.35	0.90	2.34	0.96
ZN	49			4	283	54	36	39	54.9	1.0	3.55	0.97	3.58	0.95
ZR	33	16	<2	<2	8	2	<2	<2	1.4	0.5	1.01	0.37		
K	48	1	<0.02	<0.02	4.71	2.58	2.27	2.13	1.126	0.436	0.84	0.51	0.83	0.57
SR	49			3	488	122	98	109	93.6	0.8	4.49	0.94	4.56	0.94
CE	47	2	<10	<10	305	97	81	75	63.2	0.6	4.38	0.70	4.34	0.88

Table C-V. Summary statistics for Precambrian X (?) schists, Elba, Upper Narrows, Stevens Spring

RAFT RIVER PROJECT - ROCKS

FOR GEOLOGIC CODES:PCAD WGAC WGGN PCAG

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	S. D.	ANTILN MEAN	S. D.
U	39			0.80	12.72	2.98	2.08	1.47	2.519	0.846	0.86	0.65	0.94	0.71
U-NT	39			1.10	14.10	3.75	2.60	2.55	2.934	0.782	1.13	0.56	1.11	0.57
U/TU	39			0.42	1.35	0.79	0.78	0.82	0.202	0.256	-0.27	0.27	-0.27	0.31
AG	0	39	<2	<2	<2		<2	<2						
AL	39			6.06	7.95	6.31	6.72	6.91	0.440	0.065	1.92	0.06	1.92	0.07
B	1	38	<10	<10	10	10	<10	<10	0.0	0.0	2.30	0.0		
BA	39			52	4878	1119	1052	1045	111.8	0.7	6.74	0.69	6.76	0.67
BE	35	4	<1	<1	6	1	<1	<1	1.3	0.7	0.46	0.59		
CA	39			0.17	2.52	0.78	0.74	0.56	0.421	0.538	-0.37	0.52	-0.37	0.55
CO	6	33	<4	<4	22	11	<4	<4	7.6	0.7	2.23	0.74		
CR	39			1	186	13	9	5	34.2	1.9	2.27	1.00	2.26	1.23
CU	34	5	<2	<2	30	8	5	3	7.0	0.8	1.66	0.80	1.64	1.36
FE	39			0.18	5.49	1.37	1.17	0.86	1.084	0.793	0.06	0.75	0.37	0.41
LI	39			3	58	17	13	13	13.6	0.8	2.63	0.71	2.63	0.79
MG	35	4	<0.05	<0.05	1.86	0.33	0.22	0.22	0.344	1.040	-1.35	0.66	-1.57	0.45
MN	39			51	620	178	151	160	128.4	0.7	4.97	0.66	4.96	0.69
MO	3	36	<4	<4	17	8	<4	<4	7.2	0.6	1.94	0.78		
NA	39			1.10	3.95	2.29	2.19	2.22	0.494	0.215	0.81	0.21	0.81	0.19
NB	33	6	<4	<4	121	13	7	6	20.4	1.5	2.24	0.72	1.99	0.97
NI	36	3	<2	<2	68	9	4	<2	14.9	1.6	1.66	0.94	1.40	1.47
P	39			80	2929	376	269	250	452.1	1.2	5.66	0.64	5.63	0.56
SC	37	2	<1	<1	15	3	3	2	2.6	0.7	1.14	0.55	1.07	0.61
TH	38	1	<2	<2	57	27	28	31	13.4	0.5	3.17	0.61	3.14	0.73
TI	39			40	6388	1274	1075	1138	1236.8	1.0	6.72	1.07	6.75	1.24
V	36	3	<2	<2	139	19	11	11	25.9	1.3	2.55	0.85	2.40	1.16
Y	39			1	31	10	9	10	7.3	0.7	2.11	0.72	2.13	0.76
ZN	39			7	120	37	30	11	25.8	0.7	3.43	0.65	3.43	0.52
ZR	33	6	<2	<2	15	3	3	<2	2.5	0.7	1.15	0.49		
K	39			0.80	3.56	2.49	2.53	2.71	0.554	0.222	0.88	0.23	0.90	0.31
SR	39			5	741	131	113	117	112.4	0.9	4.66	0.70	4.67	0.73
CE	37	2	<10	<10	438	95	83	85	72.3	0.8	4.32	0.75	4.26	0.57

Table C-VI Summary statistics for Archean adamellite and adamellite gneiss

RAFT RIVER PROJECT - ROCKS

FOR GEOLOGIC CODES: PCOS PCJT PCAS WGSH WGGS

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	BOXCOX MEAN	BOXCOX S. D.
U	24			0.81	4.80	2.20	2.07	2.10	1.040	0.472	0.69	0.47	0.59	0.55
U-NT	24			1.70	7.10	3.57	3.30	2.47	1.377	0.385	1.21	0.37	1.20	0.35
U/TU	24			0.24	1.06	0.64	0.63	0.49	0.229	0.360	-0.52	0.41	-0.51	0.47
AG	1	23	<2	<2	19	19	<2	<2	0.0	0.0	2.94	0.0		
AL	24			2.35	9.26	6.84	6.91	7.85	1.661	0.243	1.88	0.32	1.91	0.30
B	6	18	<10	<10	20	16	<10	<10	3.4	0.2	2.77	0.21		
BA	24			292	2252	779	701	701	395.9	0.5	6.56	0.44	6.55	0.40
BE	24			1	5	2	2	1	1.2	0.5	0.74	0.52	0.73	0.61
CA	24			0.12	1.52	0.75	0.71	1.28	0.460	0.609	-0.54	0.81	-0.51	0.89
CO	21	3	<4	<4	29	13	9	<4	9.2	0.6	2.39	0.70	2.26	1.00
CR	24			12	245	107	74	27	84.8	0.8	4.27	1.02	4.25	1.09
CU	23	1	<2	<2	77	21	11	3	22.4	1.0	2.55	1.09	2.47	1.34
FE	24			0.43	6.98	3.96	4.13	4.09	1.834	0.463	1.21	0.66	1.27	0.66
LI	24			2	42	22	19	14	11.6	0.5	2.93	0.71	2.99	0.69
MG	24			0.07	3.05	1.25	0.71	0.62	0.885	0.710	-0.10	0.93	-0.04	0.93
MN	24			78	958	401	332	690	264.0	0.7	5.75	0.75	5.76	0.60
MO	0	24	<4	<4	<4		<4	<4						
NA	24			0.07	2.81	1.21	1.41	0.12	0.836	0.693	-0.26	1.15	-0.21	1.16
ND	15	9	<4	<4	22	9	5	<4	4.7	0.5	2.11	0.46		
NI	24			5	133	47	24	19	40.7	0.9	3.43	1.00	3.45	1.13
P	24			158	3748	820	568	586	803.2	1.0	6.40	0.76	6.38	0.84
SC	24			1	19	10	12	15	5.1	0.5	2.20	0.72	2.26	0.69
TH	24			5	61	17	13	17	13.9	0.8	2.65	0.69	2.63	0.78
TI	24			442	6889	3115	2869	2794	1654.4	0.5	7.86	0.68	7.90	0.71
V	24			9	155	79	77	22	47.6	0.6	4.14	0.78	4.19	0.77
Y	24			3	75	14	10	9	14.3	1.0	2.44	0.68	2.41	0.66
ZN	24			5	141	63	66	31	37.7	0.6	3.94	0.72	3.97	0.67
ZR	10	14	<2	<2	6	3	<2	<2	1.2	0.4	1.03	0.36		
K	24			1.14	4.50	2.36	2.06	3.06	1.066	0.451	0.76	0.45	0.76	0.51
SR	24			37	186	108	113	46	49.0	0.5	4.57	0.51	4.59	0.51
CE	23	1	<10	<10	206	73	66	35	43.1	0.6	4.14	0.58	4.09	0.67

Table C-VII. Summary statistics for Archean schists

	L-U	LUNT	L-TH	L-CE	LTGM	L-CA	L-NA	L-AL	L-K	L-BA	L-SR	L-P	L-Y	L-LI	L-ZN	L-MN	L-FE	L-TI	L-SC	L-V	L-MG	L-CR	L-NI	L-CU	LCPK	LCPU	LETH	L-EU	LTOT
L-U	1.00 (252)																												
LUNT	0.89*** 0.89*** (250)	1.00 (263)																											
L-TH	0.67*** 0.65*** (228)	0.70*** 0.68*** (234)	1.00 (235)																										
L-CE	0.61*** 0.65*** (221)	0.72*** 0.74*** (227)	0.75*** 0.77*** (218)	1.00 (228)																									
LTGM	0.46*** 0.45*** (52)	0.46*** 0.54*** (55)	0.64*** 0.68*** (51)	0.56*** 0.67*** (50)	1.00 (56)																								
L-CA	0.31*** 0.33*** (175)	0.29*** 0.27*** (176)	0.20*** 0.21*** (169)	0.35*** 0.30*** (164)	0.40*** 0.36*** (43)	1.00 (177)																							
L-NA	0.31*** 0.30*** (147)	0.11 0.05 (146)	0.26*** 0.28*** (145)	0.14 0.15* (136)	0.32* 0.11 (37)	0.55*** 0.47*** (138)	1.00 (147)																						
L-AL	0.60*** 0.62*** (251)	0.71*** 0.70*** (260)	0.42*** 0.42*** (234)	0.58*** 0.58*** (228)	0.56*** 0.55*** (55)	0.61*** 0.57*** (177)	0.52*** 0.37*** (147)	1.00 (261)																					
L-K	0.59*** 0.59*** (251)	0.74*** 0.73*** (260)	0.49*** 0.50*** (235)	0.57*** 0.58*** (228)	0.54*** 0.62*** (55)	0.37*** 0.27*** (177)	0.02 -0.03 (147)	0.92*** 0.85*** (260)	1.00 (261)																				
L-BA	0.53*** 0.54*** (252)	0.66*** 0.64*** (261)	0.49*** 0.53*** (235)	0.65*** 0.65*** (228)	0.57*** 0.70*** (55)	0.50*** 0.48*** (177)	0.12 0.15* (147)	0.84*** 0.79*** (261)	0.86*** 0.84*** (261)	1.00 (263)																			
L-SR	0.50*** 0.52*** (251)	0.63*** 0.63*** (260)	0.34*** 0.36*** (234)	0.62*** 0.60*** (228)	0.47*** 0.46*** (55)	0.68*** 0.69*** (177)	0.23*** 0.19** (147)	0.80*** 0.76*** (261)	0.75*** 0.72*** (260)	0.83*** 0.81*** (261)	1.00 (261)																		
L-P	0.52*** 0.56*** (251)	0.67*** 0.69*** (261)	0.36*** 0.38*** (235)	0.66*** 0.67*** (228)	0.29** 0.41*** (55)	0.33*** 0.27*** (177)	-0.14* -0.18** (147)	0.57*** 0.60*** (261)	0.55*** 0.59*** (261)	0.64*** 0.63*** (262)	0.70*** 0.70*** (261)	1.00 (262)																	
L-Y	0.65*** 0.67*** (236)	0.73*** 0.74*** (243)	0.51*** 0.52*** (229)	0.76*** 0.75*** (225)	0.47*** 0.50*** (52)	0.63*** 0.58*** (175)	0.28*** 0.17** (147)	0.72*** 0.72*** (244)	0.62*** 0.62*** (244)	0.65*** 0.64*** (244)	0.71*** 0.70*** (244)	0.78*** 0.78*** (244)	1.00 (244)																
L-LI	0.47*** 0.51*** (244)	0.57*** 0.59*** (253)	0.30*** 0.32*** (231)	0.48*** 0.48*** (225)	0.49*** 0.48*** (55)	0.65*** 0.66*** (176)	0.24*** 0.12 (146)	0.82*** 0.81*** (253)	0.70*** 0.68*** (253)	0.75*** 0.73*** (255)	0.68*** 0.70*** (253)	0.58*** 0.59*** (254)	0.71*** 0.72*** (241)	1.00 (255)															
L-ZN	0.50*** 0.55*** (249)	0.56*** 0.60*** (258)	0.33*** 0.37*** (232)	0.53*** 0.54*** (226)	0.46*** 0.58*** (55)	0.66*** 0.68*** (177)	0.29*** 0.18** (146)	0.77*** 0.78*** (259)	0.63*** 0.64*** (258)	0.74*** 0.75*** (259)	0.71*** 0.72*** (259)	0.61*** 0.63*** (259)	0.74*** 0.74*** (242)	0.85*** 0.85*** (251)	1.00 (259)														
L-MN	0.48*** 0.52*** (252)	0.55*** 0.59*** (260)	0.21*** 0.24*** (234)	0.48*** 0.48*** (228)	0.39*** 0.43*** (55)	0.63*** 0.60*** (177)	0.30*** 0.14* (147)	0.72*** 0.73*** (261)	0.68*** 0.61*** (260)	0.65*** 0.64*** (262)	0.68*** 0.68*** (261)	0.68*** 0.70*** (261)	0.74*** 0.74*** (244)	0.78*** 0.79*** (254)	0.84*** 0.83*** (259)	1.00 (262)														
L-FE	0.48*** 0.53*** (252)	0.62*** 0.65*** (260)	0.31*** 0.36*** (234)	0.57*** 0.57*** (228)	0.40*** 0.49*** (55)	0.54*** 0.52*** (177)	-0.02 -0.17** (147)	0.76*** 0.76*** (261)	0.66*** 0.65*** (260)	0.74*** 0.74*** (262)	0.73*** 0.73*** (261)	0.73*** 0.76*** (261)	0.77*** 0.77*** (244)	0.79*** 0.80*** (254)	0.85*** 0.85*** (259)	0.84*** 0.84*** (262)	1.00 (262)													
L-TI	0.51*** 0.56*** (252)	0.66*** 0.69*** (260)	0.44*** 0.45*** (234)	0.69*** 0.68*** (228)	0.42*** 0.52*** (55)	0.47*** 0.47*** (177)	-0.12 -0.18** (147)	0.71*** 0.71*** (261)	0.64*** 0.62*** (260)	0.75*** 0.73*** (262)	0.66*** 0.68*** (261)	0.71*** 0.74*** (261)	0.74*** 0.76*** (244)	0.74*** 0.76*** (254)	0.76*** 0.78*** (259)	0.71*** 0.73*** (262)	0.87*** 0.89*** (262)	1.00 (262)												
L-SC	0.42*** 0.49*** (226)	0.57*** 0.65*** (231)	0.23*** 0.27*** (221)	0.49*** 0.53*** (214)	0.41*** 0.47*** (52)	0.47*** 0.42*** (171)	-0.15* -0.25*** (144)	0.71*** 0.74*** (232)	0.57*** 0.59*** (232)	0.56*** 0.57*** (232)	0.64*** 0.66*** (232)	0.71*** 0.74*** (232)	0.75*** 0.78*** (228)	0.73*** 0.74*** (230)	0.79*** 0.80*** (230)	0.80*** 0.80*** (232)	0.89*** 0.89*** (232)	0.85*** 0.87*** (232)	1.00 (232)											
L-V	0.46*** 0.54*** (244)	0.56*** 0.64*** (252)	0.26*** 0.33*** (229)	0.52*** 0.56*** (225)	0.38*** 0.39*** (53)	0.37*** 0.36*** (170)	-0.15* -0.21** (141)	0.64*** 0.65*** (252)	0.53*** 0.52*** (252)	0.58*** 0.57*** (252)	0.60*** 0.61*** (252)	0.73*** 0.76*** (252)	0.68*** 0.70*** (238)	0.65*** 0.65*** (245)	0.73*** 0.71*** (250)	0.71*** 0.68*** (252)	0.87*** 0.85*** (252)	0.88*** 0.90*** (252)	0.91*** 0.88*** (228)	1.00 (252)										
L-MG	0.26*** 0.33*** (186)	0.32*** 0.40*** (187)	-0.00 0.03 (179)	0.33*** 0.37*** (176)	0.29* 0.24 (43)	0.55*** 0.51*** (152)	0.05 -0.06 (135)	0.73*** 0.74*** (187)	0.41*** 0.43*** (187)	0.48*** 0.47*** (187)	0.55*** 0.56*** (187)	0.56*** 0.60*** (187)	0.66*** 0.70*** (185)	0.81*** 0.84*** (187)	0.82*** 0.83*** (187)	0.81*** 0.82*** (187)	0.87*** 0.89*** (187)	0.84*** 0.86*** (187)	0.87*** 0.86*** (184)	0.82*** 0.80*** (186)	1.00 (187)									
L-CR	0.22*** 0.28*** (252)	0.33*** 0.38*** (261)	0.21*** 0.17*** (235)	0.30*** 0.31*** (228)	0.19 0.15 (55)	0.11 0.08 (177)	-0.31*** -0.44*** (147)	0.24*** 0.25*** (261)	0.15*** 0.14** (261)	0.28*** 0.25*** (263)	0.23*** 0.23*** (261)	0.41*** 0.44*** (262)	0.30*** 0.31*** (244)	0.30*** 0.31*** (255)	0.39*** 0.35*** (259)	0.32*** 0.31*** (262)	0.53*** 0.52*** (262)	0.63*** 0.64*** (262)	0.58*** 0.57*** (232)	0.75*** 0.74*** (252)	0.51*** 0.48*** (187)	1.00 (263)								
L-NI	0.31*** 0.37*** (236)	0.41*** 0.47*** (244)	0.08 0.14** (221)	0.28*** 0.33*** (218)	0.15 0.21 (55)	0.29*** 0.23*** (168)	-0.12 -0.26*** (138)	0.52*** 0.50*** (245)	0.37*** 0.37*** (245)	0.40*** 0.38*** (245)	0.43*** 0.40*** (245)	0.52*** 0.56*** (245)	0.55*** 0.54*** (231)	0.57*** 0.54*** (238)	0.67*** 0.63*** (244)	0.67*** 0.63*** (245)	0.78*** 0.76*** (245)	0.69*** 0.70*** (245)	0.82*** 0.78*** (220)	0.82*** 0.78*** (240)	0.81*** 0.76*** (183)	0.71*** 0.69*** (245)	1.00 (245)							
L-CU	0.24*** 0.27*** (231)	0.26*** 0.30*** (239)	0.02 0.05 (214)	0.23*** 0.22*** (211)	0.02 0.02 (52)	0.34*** 0.30*** (161)	0.09 -0.01 (130)	0.37*** 0.39*** (240)	0.20*** 0.20*** (239)	0.33*** 0.33*** (241)	0.37*** 0.36*** (240)	0.42*** 0.43*** (240)	0.40*** 0.39*** (224)	0.43*** 0.42*** (234)	0.55*** 0.50*** (238)	0.56*** 0.53*** (241)	0.58*** 0.56*** (241)	0.50*** 0.49*** (241)	0.59*** 0.56*** (212)	0.58*** 0.52*** (231)	0.58*** 0.53*** (171)	0.44*** 0.42*** (241)	0.63*** 0.61*** (229)	1.00 (241)						
LCPK	0.48*** 0.52*** (61)	0.56*** 0.62*** (65)	0.52*** 0.54*** (57)	0.50*** 0.52*** (58)	****** ****** (2)	-0.03 0.11 (42)	-0.15 -0.00 (31)	0.45*** 0.53*** (65)	0.65*** 0.78*** (64)	0.58*** 0.62*** (65)	0.42*** 0.50*** (65)	0.45*** 0.51*** (65)	0.35*** 0.40*** (63)	0.39*** 0.42*** (62)	0.38*** 0.49*** (64)	0.25* 0.35*** (65)	0.34*** 0.41*** (65)	0.41*** 0.48*** (65)	0.29** 0.40*** (57)	0.30** 0.43*** (63)	0.02 0.08 (43)	0.29** 0.28** (65)	0.12 0.27** (59)	-0.01 0.05 (63)	1.00 (65)					
LCPU	0.52*** 0.59*** (61)	0.54*** 0.64*** (65)	0.58*** 0.62*** (57)	0.51*** 0.58*** (50)	****** ****** (2)	0.00 0.16 (42)	-0.04 0.16 (31)	0.37*** 0.52*** (65)	0.53*** 0.64*** (64)	0.48*** 0.56*** (65)	0.33*** 0.45*** (65)	0.39*** 0.50*** (65)	0.35*** 0.43*** (63)	0.32** 0.38*** (62)	0.35*** 0.46*** (64)	0.22* 0.33*** (65)	0.29** 0.39*** (65)	0.38*** 0.47*** (65)	0.28** 0.41*** (57)	0.28** 0.41*** (63)	-0.00 0.09 (43)	0.31** 0.28** (65)	0.10 0.24* (59)	0.03 0.10 (63)	0.91*** 0.89*** (65)	1.00 (65)				
LETH	0.42*** 0.49*** (104)	0.57*** 0.62*** (110)	0.62*** 0.56*** (95)	0.49*** 0.56*** (96)	****** ****** (2)	0.08 0.24** (71)	0.13 0.28** (59)	0.50*** 0.57*** (109)	0.59*** 0.66*** (108)	0.56*** 0.63*** (110)	0.45*** 0.65*** (109)	0.42*** 0.50*** (109)	0.36*** 0.46*** (103)	0.34*** 0.42*** (105)	0.34*** 0.46*** (108)	0.24** 0.36*** (110)	0.33*** 0.47*** (110)	0.42*** 0.51*** (110)	0.15 0.32*** (96)	0.21** 0.48*** (105)	-0.04 0.12 (73)	0.17* 0.21** (110)	0.04 0.28** (100)	0.04 0.14 (102)	0.86*** 0.92*** (65)	0.85*** 0.88*** (65)	1.00 (112)			
L-EU	0.48*** 0.52*** (104)	0.65*** 0.66*** (110)	-0.47*** 0.50*** (95)	0.56*** 0.57*** (96)	****** ****** (2)	0.05 0.11 (71)	-0.06 -0.05 (59)	0.53*** 0.54*** (109)	0.62*** 0.64*** (108)	0.55*** 0.56*** (110)	0.49*** 0.52*** (109)	0.53*** 0.55*** (109)	0.45*** 0.47*** (103)	0.36*** 0.35*** (105)	0.35*** 0.40*** (108)	0.32*** 0.35*** (110)	0.45*** 0.47*** (110)	0.53*** 0.54*** (110)	0.38*** 0.47*** (96)	0.40*** 0.49*** (105)	0.06 0.16 (73)	0.31*** 0.34*** (110)	0.22** 0.31*** (100)	0.13 0.17* (102)	0.66*** 0.70*** (65)	0.78*** 0.85*** (65)	0.66*** 0.71*** (112)	1.00 (112)	
LTOT	-0.03 0.10 (61)	0.02 0.13 (64)	0.06 0.09 (57)	-0.04 0.11 (58)	****** ****** (2)	-0.12 0.03 (42)	-0.13 -0.13 (31)	-0.07 0.11 (64)	0.02 0.11 (64)	0.04 0.06 (64)	-0.10 0.03 (64)	0.02 0.06 (64)	-0.13 0.03 (63)	-0.01 0.05 (61)	0.00 0.13 (63)	-0.13 0.00 (64)	-0.04 0.07 (64)	0.03 0.12 (64)	-0.00 0.15 (57)	-0.02 0.11 (63)	-0.04 -0.00 (43)	0.33*** 0.16 (64)	-0.13 0.01 (59)	-0.07 0.06 (62)	0.45*** 0.12 (64)	0.64*** 0.39*** (64)	0.41*** 0.16 (64)	0.39*** 0.47*** (64)	1.00 (64)

Notes:

(1) Pearson correlation/Spearman correlation/sample size. If either element has concentration level below the detection limit, it is omitted from the pairwize computation.

(2) * - .10

** - .05

*** - .01

TABLE C-VIII. Correlation matrix for variables determined in rock samples

PAGES 288 to 289

WERE INTENTIONALLY

LEFT BLANK

RAFT RIVER ROCK

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)	TH/U
154440	34	3	2.3	170	170		750	15.	24	4.1	5	3.9	4	4.0
154455	3	<2	1.4	62	<10		650	5.0	8	1.9	3	2.2	1	0.59
154456	96	16	0.22	65	32		550	3.0	2	0.8	2	0.9	1	17.
154457	18	8	3.4	110	150		810	17.	22	1.4	6	6.3	7	2.0
154490	4	<2	0.13	4	<10									1.7
154498	40	2	3.3	110	89		9100	8.3	310	6.7	51	37.	46	1.6
154511	130	<2	2.1	230	81									5.0
154512	16	3	3.0	53	66									15.
154514	8	<2	0.74	8	18									2.2
154517	6	<2	0.22	5	19	0								12.
154523	100	4	2.0	73	89			2.1		3.1		17.		4.1
154524	10	<2	1.1	14	<10			2.7		4.3		25.		1.7
154525	44	<2	2.1	31	30			3.8		4.9		23.		6.5
154526	130	2	1.3	82	150			3.8		7.4		28.		2.3
154529								2.7		5.4		31.		
154532	29	<2	0.17	13	10			0.8		3.0		7.1		1.3
154533	5	<2	0.72	23	<10			1.2		1.5		11.		5.0
154534	30	2	3.3	61	29			5.5		3.0		46.		12.
154535	280	<2	3.9	7	10			3.7		4.1		23.		1.9
154536	48	2	1.8	100	53			0.8		2.7		13.		11.
154537	<2	<2	<0.02	<1	<10			3.9		3.8		25.		
154539	9	<2	2.7	11	<10			1.7		3.9		12.		2.7
154542	8	<2	0.87	24	17									4.6
154547	65	3	2.1	260	150			4.0		13.		49.		7.4
154550	76	280	2.9	48	150									4.1
154551	4	2	0.16	4	17			0.5		1.7		11.		0.91
154552	23	2	2.7	120	56			3.9		5.7		57.		11.
154553	6	<2	<0.02	3	<10			0.4	100	0.8	37	4.1	32	10.
154554	12	2	0.43	29	17									20.
154555	21	4	2.2	76	110									12.
154561	130	3	1.7	77	120	3800								4.4
154566	4	2	0.07	23	48									6.7
154568	3	2	0.14	31	45	260								1.1
154581	27	2	2.6	130	57									12.
154587	100	20	1.8	300	<10	1200								2.0
154589														
154596	20	<2	0.83	28	18	540								1.7
154601	12	<2	0.76	11	15	540								2.0
154607	24	2	3.5	140	110									3.8
154609	12	2	2.7	190	61									5.5
154612	15	<2	2.5	400	69									7.4
154614	11	3	2.1	87	82									7.3
154646	84	64	1.3	150	73									3.7
154655	85	84	1.8	180	65									1.2
154718	3	<2	0.05	3	22			0.1		5.0		11.		10.
154719	35	2	2.2	71	83			0.1		13.		18.		5.4
154720	12	<2	0.11	8	22			0.0		3.4		8.2		5.0
154721	4	<2	0.46	13	13			0.1		4.7		9.8		1.1
154722	32	2	3.4	140	56			0.2		21.		28.		1.9
154723	31	<2	4.1	160	130			0.3		27.		26.		3.1
154724	5	2	0.93	9	69			0.1		8.6		18.		3.6
154725	16	<2	0.73	23	41			0.2		16.		16.		3.3
154726	11	<2	0.04	9	<10			0.0		0.7		3.3		5.0
154727	22	3	3.3	160	100			0.4		4.9		28.		3.3
154728	4	<2	0.16	3	<10			0.1		1.2		9.4		2.5

TABLE C-IX. Analyses of rock samples

1-c

RAFT RIVER ROCK

SECTION 1 OF 3

OR SAMPLE NUMBER	D. D. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
154729	40-******	-*******	-3- -											
154734	40-41.889	-113.210	-3-92-	1.1	1.1	1.0	<2	1.2	<10	130	<1	0.05	<4	12
154739	40-41.883	-113.213	-3-92-	0.95	1.6	0.59	<2	0.61	<10	37	<1	0.11	<4	9
154743	40-41.932	-113.253	-3-92-	0.26	0.50	0.52	<2	0.23	<10	30	<1	<0.05	<4	14
154745	40-41.927	-113.207	-3-92-	1.5	3.1	0.48	<2	6.7	<10	300	2	0.31	24	240
154748	40-41.922	-113.207	-3-92-	1.8	1.7	1.1	<2	3.0	<10	1000	1	0.30	<4	15
154752	40-41.925	-113.192	-3-92-	1.7	2.7	0.63	<2	7.0	<10	610	1	1.0	19	230
154823	40-42.177	-113.682	-3-92-	4.7	6.1	0.77	<2	7.4	<10	4900	3	2.5	8	18
154828	40-42.172	-113.678	-3-92-	1.4	2.5	0.57	<2	6.3	<10	1100	2	0.92	<4	12
154836	40-42.321	-113.503	-3-92-	2.2	5.0	0.43	<2	8.5	34	1100	3	<0.05	<4	91
154859	40-42.193	-113.671	-3-92-	2.5	2.7	0.94	<2	6.6	<10	1600	2	0.57	<4	12
154878	40-41.684	-113.735	-3-92-	1.9	1.7	1.1	<2	7.3	<10	880	<1	1.2	<4	7
154884	40-42.056	-113.671	-3-92-	2.4	3.2	0.74	<2	0.81	10	140	<1	<0.05	<4	94
154887	40-42.067	-113.669	-3-92-	1.2	1.6	0.74	<2	0.85	<10	67	<1	<0.05	<4	39
154888	40-42.072	-113.672	-3-92-	6.8	7.6	0.89	<2	0.83	<10	150	1	<0.05	<4	230
154889	40-42.198	-113.683	-3-92-	2.1	2.2	0.95	<2	6.7	<10	1600	1	0.60	<4	14
154890	40-42.206	-113.677	-3-92-	5.2	8.4	0.62	<2	1.3	10	150	1	<0.05	<4	300
154919	40-41.660	-113.739	-3-92-	3.0	3.1	0.97	<2	7.2	<10	1400	1	1.3	<4	10
156401	40-42.112	-113.698	-3-92-	3.8	5.5	0.69	<2	6.5	<10	31	2	0.57	<4	6
156405	40-42.109	-113.718	-3-92-	1.9	3.9	0.49	<2	7.9	<10	2300	2	1.2	4	12
156407	40-42.135	-113.724	-3-92-	0.84	0.80	1.0	<2	0.70	<10	100	1	0.12	<4	12
156408	40-42.149	-113.716	-3-92-	1.0	1.0	1.0	<2	0.58	<10	80	<1	<0.05	<4	17
156409	40-42.147	-113.755	-3-92-	0.84	0.70	1.2	<2	7.4	<10	260	1	6.2	30	190
156411	40-42.339	-113.541	-3-92-	0.96	0.90	1.1	<2	0.46	<10	75	<1	0.26	<4	12
156412	40-42.336	-113.579	-3-92-	5.0	4.5	1.1	<2	7.1	<10	1000	1	0.43	<4	10
156413	40-42.320	-113.651	-3-92-	1.9	2.7	0.72	<2	2.9	<10	310	2	<0.05	<4	42
156414	40-42.314	-113.580	-3-92-	2.6	5.2	0.49	<2	7.7	16	870	3	0.42	7	67
156415	40-42.316	-113.558	-3-92-	1.6	2.6	0.63	<2	1.3	<10	270	1	0.50	<4	23
156416	40-42.322	-113.538	-3-92-	1.8	4.2	0.44	<2	1.8	<10	310	1	1.0	10	34
156420	40-42.076	-113.704	-3-92-	0.79	1.2	0.66	<2	6.6	<10	360	1	0.62	<4	6
156425	40-42.008	-113.692	-3-92-	0.88	0.80	1.1	<2	0.38	<10	23	<1	<0.05	<4	8
156426	40-42.009	-113.692	-3-92-	1.5	1.8	0.82	<2	0.94	<10	220	<1	0.07	<4	56
156468	40-41.873	-113.582	-3-92-	1.0	1.2	0.86	<2	0.44	<10	72	<1	0.06	8	18
156471	40-41.879	-113.552	-3-92-	0.25	1.0	0.25	<2	0.86	<10	120	<1	<0.05	<4	9
156472	40-41.886	-113.537	-3-92-	2.2	6.7	0.33	<2	7.9	25	850	4	0.82	5	59
156594	40-41.916	-113.660	-3-92-	1.9	3.4	0.55	<2	7.3	<10	1300	4	0.33	10	72
156601	40-42.361	-113.596	-3-92-	1.5	3.5	0.42	<2	4.3	10	850	1	0.10	<4	37
156602	40-42.363	-113.590	-3-92-	1.4	1.6	0.85	<2	1.0	<10	270	<1	<0.05	<4	31
156646	40-41.922	-113.686	-3-92-	1.9	5.6	0.34	<2	7.7	<10	1100	7	0.48	<4	42
156675	40-41.939	-113.695	-3-92-	3.1	5.0	0.63	<2	7.2	<10	960	5	0.44	4	36
156680	40-41.951	-113.539	-3-92-	0.49	0.60	0.82	<2	0.31	<10	35	<1	<0.05	<4	10
156684	40-41.875	-113.782	-3-92-	2.5	4.8	0.52	<2	7.2	<10	950	6	1.2	4	35
156698	40-41.986	-113.730	-3-92-	0.71	0.60	1.2	<2	0.48	<10	43	<1	<0.05	<4	11
156699	40-41.986	-113.730	-3-92-	0.33	1.1	0.30	<2	5.9	<10	1100	1	0.48	<4	9
156700	40-41.987	-113.736	-3-92-	3.0	4.5	0.66	<2	7.1	<10	1000	2	0.95	8	48
156707	40-42.172	-113.712	-3-92-	1.7	2.4	0.72	<2	6.1	<10	1100	2	0.92	<4	12
156709	40-42.164	-113.704	-3-92-	1.3	2.2	0.57	<2	6.4	<10	370	2	1.3	12	130
156710	40-42.158	-113.695	-3-92-	1.5	2.3	0.67	<2	6.7	<10	1200	1	0.63	<4	13
156719	40-42.198	-113.693	-3-92-	1.4	1.9	0.75	<2	0.86	<10	120	<1	<0.05	<4	76
156720	40-42.197	-113.692	-3-92-	4.8	7.0	0.68	<2	1.2	13	270	1	<0.05	<4	210
156724	40-42.196	-113.692	-3-92-	1.5	2.0	0.75	<2	6.7	<10	1300	1	0.50	<4	11
156730	40-42.376	-113.630	-3-92-	0.54	0.50	1.1	<2	0.36	<10	35	<1	<0.05	<4	10
156731	40-42.375	-113.638	-3-92-	1.1	3.2	0.35	<2	2.9	<10	540	1	0.13	<4	31
156738	40-42.133	-113.664	-3-92-	<0.25	0.50	0.25	<2	0.49	<10	160	<1	<0.05	<4	15
156739	40-42.131	-113.858	-3-92-	0.89	0.90	0.99	<2	1.2	<10	190	<1	<0.05	<4	23

TABLE C-IX. Analyses of rock samples

2-a

RAFT RIVER ROCK

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
154729															
154734	2	0.27	2	<0.05	17	<4	<0.05	<4	2	66	1	<2	620	10	1
154739	<2	0.40	1	<0.05	8	<4	<0.05	<4	<2	100	1	2	220	8	<1
154743	5	0.13	<1	<0.05	15	<4	<0.05	<4	2	32	<1	3	81	3	<1
154745	25	6.0	26	2.6	540	<4	1.7	<4	110	520	16	9	3800	130	6
154748	12	0.43	5	0.19	78	<4	0.74	<4	8	160	1	12	440	9	4
154752	46	4.7	30	2.0	550	<4	1.9	<4	89	590	14	12	3200	120	9
154823	15	4.5	32	0.91	420	<4	2.2	11	11	2900	5	30	6400	89	29
154828	2	1.1	15	0.21	84	<4	2.4	7	5	190	3	32	1200	14	8
154836	7	3.0	12	0.53	190	<4	0.11	13	14	260	13	9	5500	90	4
154859	7	1.3	15	0.27	180	<4	2.1	12	8	370	3	33	1500	14	8
154878	12	0.54	13	0.12	59	<4	2.7	<4	2	150	3	18	280	5	4
154884	5	0.63	5	0.15	31	<4	<0.05	<4	7	130	2	44	1400	15	3
154887	8	0.24	6	0.15	16	<4	<0.05	<4	5	39	1	16	430	6	3
154888	4	0.72	4	0.07	50	<4	<0.05	<4	5	140	2	150	2800	25	3
154889	3	1.5	13	0.23	180	<4	2.1	8	4	340	3	37	1500	15	9
154890	5	0.24	1	0.07	10	<4	<0.05	<4	6	260	3	130	650	20	6
154919	11	1.4	58	0.25	57	<4	2.5	5	2	250	2	18	1400	11	4
156401	3	0.44	27	<0.05	270	<4	2.6	20	<2	70	4	17	250	2	8
156405	3	2.3	34	0.47	240	<4	2.2	9	5	780	4	28	2700	29	10
156407	2	0.17	11	0.09	53	<4	0.08	<4	4	90	1	10	610	5	5
156408	2	0.10	3	<0.05	9	<4	<0.05	<4	2	35	1	5	150	5	1
156409	43	7.8	27	3.4	1500	<4	1.0	<4	70	630	31	4	9000	290	21
156411	7	0.38	2	0.05	64	<4	<0.05	<4	6	1100	2	<2	190	11	5
156412	3	1.1	8	0.23	150	<4	1.9	7	5	320	4	30	820	14	13
156413	12	0.69	7	0.25	68	<4	0.07	<4	6	270	5	6	850	29	3
156414	58	3.5	33	0.58	170	<4	0.15	10	20	1500	12	15	3200	71	13
156415	8	4.4	4	0.10	94	<4	<0.05	<4	9	2100	5	9	1500	45	12
156416	<2	18.	4	0.12	190	<4	<0.05	<4	14	4600	8	8	350	160	31
156420	<2	0.40	18	<0.05	140	<4	2.6	8	<2	65	2	6	240	3	2
156425	2	0.16	1	<0.05	7	<4	<0.05	<4	2	63	<1	6	56	6	1
156426	3	0.39	5	0.11	14	<4	<0.05	<4	6	330	1	15	570	13	3
156468	15	0.66	1	0.11	29	<4	<0.05	<4	27	180	1	2	530	6	1
156471	5	0.19	2	<0.05	10	<4	<0.05	<4	3	53	<1	<2	160	3	<1
156472	12	3.9	22	0.70	360	<4	0.10	10	14	3500	13	9	3600	64	14
156594	22	4.1	16	0.59	710	<4	0.29	17	31	780	10	19	3500	67	21
156601	<2	2.7	7	0.18	44	<4	0.11	<4	10	370	6	14	2200	35	5
156602	4	0.17	1	<0.05	12	<4	<0.05	<4	2	58	1	12	320	8	2
156646	9	4.4	27	0.84	640	<4	2.6	190	8	1900	9	27	7500	57	38
156675	11	4.1	37	0.90	550	<4	2.8	160	12	1700	8	24	6000	54	34
156680	<2	0.08	1	<0.05	6	<4	0.05	<4	<2	16	<1	6	81	4	1
156684	8	4.6	40	0.89	810	<4	2.3	160	14	1900	8	21	6600	58	41
156698	2	0.08	2	<0.05	10	<4	<0.05	<4	<2	82	1	5	120	4	2
156699	3	0.45	7	0.17	59	<4	1.3	<4	4	180	1	4	540	6	2
156700	19	2.5	36	1.1	230	<4	1.4	<4	24	410	6	77	3100	54	12
156707	3	1.4	20	0.24	86	<4	2.0	6	4	510	2	32	1000	18	11
156709	18	3.7	43	1.1	390	<4	2.2	18	64	180	9	11	3400	55	4
156710	2	1.3	16	0.33	130	<4	2.0	4	4	430	3	34	1300	12	10
156719	2	0.17	1	0.05	5	<4	<0.05	<4	4	24	1	27	470	12	1
156720	2	0.23	1	0.07	12	<4	<0.05	<4	4	170	2	130	860	23	4
156724	<2	1.6	20	0.28	180	<4	2.3	17	3	260	4	31	1700	20	8
156730	3	0.18	1	<0.05	13	<4	<0.05	<4	2	53	<1	2	200	3	1
156731	<2	3.1	6	0.15	77	<4	0.10	<4	11	590	6	15	1600	28	8
156738	3	0.18	3	<0.05	7	<4	<0.05	<4	2	28	1	7	340	7	1
156739	3	0.48	8	0.08	6	<4	<0.05	<4	4	26	1	5	620	9	1

TABLE C-IX. Analyses of rock samples

2-b

RAFT RIVER ROCK

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPL (CPM)	ETH (PPM)	CPTH (CPM)	TH/U
154729								0.1		1.4		6.8		
154734	6	<2	0.55	37	21			0.2		2.3		15.		0.91
154739	3	<2	0.24	51	<10			0.3		4.0		21.		1.3
154743	5	<2	0.09	3	11			0.1		1.3		7.2		6.0
154745	54	2	0.76	41	29			0.2		3.0		18.		2.9
154748	9	<2	1.8	84	54			0.3		3.2		19.		7.1
154752	100	<2	1.4	120	41			0.3		2.5		15.		4.4
154823	95	8	2.4	740	440	7800								4.9
154828	34	2	2.3	120	85	9300								13.
154836	26	<2	4.3	93	72	7200								1.8
154859	40	3	3.1	140	88									12.
154878	22	2	2.7	160	46	3000								11.
154884	12	4	0.50	10	88									14.
154887	9	2	0.45	3	46									10.
154888	12	12	0.41	10	68		8700	0.7	39	3.4	19	9.3	12	19.
154889	42	4	2.5	150	120	7500								17.
154890	8	11	0.58	20	190	12000								15.
154919	86	2	2.0	180	46									5.8
156401	22	3	2.6	17	14		12000	2.7	140	11.	57	26.	34	3.1
156405	66	2	3.0	190	120									7.2
156407	18	<2	0.39	16	42									13.
156408	10	<2	0.27	12	19									5.0
156409	110	2	0.36	170	<10									5.7
156411	8	<2	0.27	22	20		7600	1.2	57	2.8	21	14.	18	1.1
156412	27	3	3.4	110	89		8400	4.1	180	4.8	47	38.	48	6.7
156413	9	<2	1.3	28	43									2.2
156414	47	<2	4.7	110	140									2.9
156415	16	<2	1.1	200	46									3.5
156416	30	<2	1.4	190	20									1.9
156420	20	2	2.6	100	<10									5.0
156425	4	<2	0.14	40	16									7.5
156426	7	2	0.52	19	41									8.3
156468	7	<2	0.15	6	19	9								1.7
156471	4	<2	0.57	17	<10	14								1.0
156472	39	2	3.9	160	97	40								1.3
156594	79	4	2.3	81	130	11000								5.6
156601	18	3	3.1	71	75			0.3		25.		41.		4.0
156602	2	2	0.87	48	32			0.1		8.0		16.		7.5
156646	110	2	2.2	100	310									4.8
156675	130	2	1.9	120	270			0.3		5.6		37.		4.8
156680	3	<2	0.10	9	16			0.0		0.8		4.8		10.
156684	150	5	1.9	180	240									4.4
156698	6	2	0.18	24	24			0.0		0.9		4.8		8.3
156699	7	<2	3.1	130	19			0.5		14.		140.		3.6
156700	36	6	2.6	130	230									17.
156707	35	3	2.1	180	120			0.4		4.3		35.		13.
156709	100	<2	1.3	160	44			0.3		3.5		24.		5.0
156710	30	3	2.5	220	140			0.5		7.0		64.		15.
156719	5	4	0.40	5	43									14.
156720	5	11	0.57	12	96									18.
156724	45	3	2.3	130	100									16.
156730	3	<2	0.12	3	11									4.0
156731	10	2	2.0	99	64									4.7
156738	5	2	0.24	4	13			0.1		2.8		14.		14.
156739	3	<2	0.57	3	13			0.2		2.1		14.		5.6

TABLE C-IX. Analyses of rock samples

RAFT RIVER ROCK

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
156740	40	-42.132	-113.857	-3-92-	1.0	1.3	0.80	<2	3.2	12	630	<1	<0.05	<4	22
156741	40	-42.130	-113.842	-3-92-	0.83	0.90	0.92	<2	0.93	<10	200	<1	<0.05	<4	14
156742	40	-42.115	-113.832	-3-92-	0.91	2.0	0.45	<2	6.8	<10	2000	3	1.2	<4	10
156791	40	-******	-********	-3-92-	0.61	0.70	0.87	<2	0.20	<10	82	<1	0.06	<4	15
156792	40	-******	-********	-3-92-	0.84	0.70	1.2	<2	0.28	<10	82	<1	<0.05	<4	15
156800	40	-42.006	-113.721	-3-92-	2.4	3.3	0.74	<2	6.9	<10	500	5	0.57	23	210
156807	40	-42.190	-113.657	-3-92-	2.2	2.7	0.82	<2	6.8	<10	1200	1	0.76	<4	8
156808	40	-42.194	-113.642	-3-92-	2.8	3.5	0.80	<2	8.2	<10	1100	2	0.71	19	28
156809	40	-42.196	-113.635	-3-92-	6.0	7.6	0.79	<2	1.3	<10	240	1	0.12	<4	200
156812	40	-41.665	-113.746	-3-92-	1.5	2.5	0.60	<2	6.5	<10	2000	1	0.64	<4	9
156817	40	-42.347	-113.619	-3-92-	2.1	3.8	0.55	<2	8.4	16	870	4	0.31	7	58
156850	40	-42.106	-113.717	-3-92-	3.5	4.2	0.83	<2	6.9	<10	2100	2	1.1	4	12
156855	40	-42.091	-113.682	-3-92-	2.1	2.6	0.81	<2	6.9	<10	1500	1	1.2	<4	16
156859	40	-42.167	-113.700	-3-92-	2.1	3.2	0.65	<2	4.6	<10	640	1	0.49	8	91
158519	40	-41.912	-113.800	-3-92-	0.41	0.70	0.59	<2	1.4	<10	190	<1	<0.05	<4	16
158520	40	-41.977	-113.841	-3-92-	1.6	3.1	0.51	<2	3.8	<10	290	<1	0.14	<4	7
158524	40	-41.959	-113.702	-3-92-	2.2	5.9	0.37	<2	10.	47	1000	4	0.27	7	90
158526	40	-41.000	-113.000	-3-92-	1.8	2.8	0.66	<2	3.4	16	450	1	0.34	4	47
158528	40	-41.952	-113.670	-3-92-	<0.25	0.40	0.31	<2	0.85	<10	54	<1	0.10	<4	41
158529	40	-41.952	-113.670	-3-92-	6.6	7.1	0.92	<2	8.9	39	560	3	1.6	20	140
158531	40	-41.983	-113.708	-3-92-	1.7	2.3	0.73	<2	6.6	<10	320	1	0.38	<4	13
158535	40	-41.786	-113.577	-3-92-	1.7	3.3	0.52	<2	6.8	<10	630	2	0.21	<4	69
158540	40	-41.788	-113.685	-3-92-	2.6	4.1	0.63	<2	7.5	11	640	2	0.34	10	89
158547	40	-41.787	-113.722	-3-92-	0.55	0.90	0.61	<2	0.92	<10	94	<1	<0.05	<4	10
158554	40	-41.856	-113.508	-3-92-	4.8	6.2	0.77	<2	6.7	<10	660	1	0.65	<4	8
158570	40	-41.858	-113.413	-3-92-	0.40	1.0	0.40	<2	1.1	<10	56	<1	<0.05	<4	7
158579	40	-41.846	-113.634	-3-92-	1.1	1.1	1.0	<2	6.2	<10	730	1	0.17	<4	4
158580	40	-41.846	-113.634	-3-92-	0.86	1.3	0.66	<2	2.8	22	270	<1	0.08	<4	27
158582	40	-41.844	-113.627	-3-92-	1.2	0.90	1.3	<2	2.2	25	480	<1	<0.05	<4	22
158587	40	-41.783	-113.618	-3-92-	0.98	0.90	1.1	<2	0.31	<10	45	1	0.28	<4	20
158588	40	-41.767	-113.619	-3-92-	0.29	0.40	0.72	<2	0.27	<10	32	<1	<0.05	<4	18
158590	40	-41.839	-113.533	-3-92-	0.84	0.80	1.0	<2	0.73	<10	38	<1	<0.05	<4	37
158591	40	-41.858	-113.528	-3-92-	2.1	2.3	0.92	<2	5.7	<10	560	4	1.2	19	180
158592	40	-41.767	-113.665	-3-92-	0.58	0.60	0.97	<2	0.39	<10	70	<1	<0.05	<4	8
158595	40	-41.735	-113.729	-3-92-	<0.25	0.10	1.3	<2	<0.05	<10	15	<1	<0.05	<4	4
158596	40	-41.735	-113.729	-3-92-	3.3	2.4	1.4	<2	6.6	<10	170	<1	0.41	<4	1
158598	40	-41.858	-113.528	-3-92-	2.9	4.6	0.63	<2	6.7	<10	1100	1	0.27	<4	13
158601	40	-41.723	-113.767	-3-92-	4.8	6.4	0.75	<2	7.0	<10	52	6	0.26	<4	3
158615	40	-41.765	-113.727	-3-92-	1.6	1.6	1.0	<2	6.1	10	1300	1	0.63	22	27
158618	40	-41.979	-113.828	-3-92-	1.6	2.2	0.73	<2	1.3	<10	130	<1	<0.05	<4	30
158619	40	-41.977	-113.825	-3-92-	5.3	5.8	0.92	<2	7.0	<10	160	4	0.49	<4	1
158621	40	-41.969	-113.822	-3-92-	2.2			<2	6.2	<10	560	4	0.52	<4	14
158625	40	-41.957	-113.806	-3-92-	0.56	0.90	0.62	<2	2.0	<10	590	<1	0.14	<4	17
158632	40	-41.773	-113.759	-3-92-	2.5	2.3	1.1	<2	7.0	<10	1700	1	0.50	<4	8
158639	40	-41.776	-113.769	-3-92-	1.1	0.80	1.3	<2	0.81	<10	220	<1	<0.05	<4	14
158643	40	-41.783	-113.741	-3-92-	1.3	1.6	0.84	<2	0.32	<10	30	<1	<0.05	<4	10
158644	40	-41.776	-113.738	-3-92-	2.9	3.9	0.74	<2	7.9	27	950	2	0.16	<4	10
158645	40	-41.763	-113.738	-3-92-	1.4	1.7	0.80	<2	7.0	<10	1400	1	0.56	<4	6
158649	40	-42.282	-113.603	-3-92-	0.83	1.3	0.64	<2	0.74	<10	230	1	0.28	<4	27
158650	40	-42.282	-113.603	-3-92-	0.83	0.90	0.92	<2	0.79	<10	160	<1	0.05	<4	17
158651	40	-42.282	-113.603	-3-92-	0.54	0.60	0.90	<2	0.54	<10	200	<1	<0.05	<4	21
158652	40	-42.282	-113.603	-3-92-	5.1	8.0	0.64	<2	1.7	<10	480	<1	0.07	<4	78
158653	40	-42.282	-113.603	-3-92-	2.8	3.5	0.80	<2	1.0	<10	190	<1	<0.05	<4	73
158654	40	-42.282	-113.603	-3-92-	0.53	0.60	0.88	<2	0.50	<10	45	<1	<0.05	<4	26
158655	40	-41.924	-113.781	-3-92-	0.91	0.70	1.3	<2	0.79	<10	120	<1	<0.05	<4	35

TABLE C-IX. Analyses of rock samples

3-a

RAFT RIVER ROCK

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
156740	<2	0.84	4	0.11	12	<4	0.05	<4	6	110	3	7	1300	15	2
156741	2	0.41	25	0.18	26	<4	0.05	<4	2	52	1	4	530	6	1
156742	7	0.98	33	0.16	250	<4	2.5	10	3	240	2	5	700	8	3
156791	9	0.46	2	<0.05	73	<4	<0.05	<4	5	200	1	5	97	4	1
156792	5	0.33	<1	<0.05	25	<4	<0.05	<4	3	88	1	2	110	3	1
156800	35	5.4	35	2.1	330	<4	1.5	9	78	230	17	7	5300	160	5
156807	<2	1.6	15	0.27	150	<4	2.3	13	2	380	3	55	1700	14	12
156808	<2	7.0	42	2.9	500	<4	2.3	4	33	1600	12	47	6900	150	29
156809	6	0.32	4	0.13	33	<4	<0.05	<4	8	530	2	81	670	17	5
156812	6	1.6	47	0.24	110	<4	1.8	5	3	680	4	19	1500	21	9
156817	4	3.8	15	0.71	100	<4	0.11	12	26	1200	14	18	3700	70	33
156850	18	2.3	25	0.34	280	<4	2.1	14	5	680	4	29	2100	27	15
156855	3	1.9	25	0.36	160	<4	2.3	12	6	840	3	31	2100	26	10
156859	20	3.0	12	0.83	520	<4	1.3	8	23	460	8	16	3400	67	14
158519	2	0.31	5	<0.05	14	<4	<0.05	<4	4	12	1	2	340	5	1
158520	4	0.40	10	0.05	180	<4	0.66	14	4	96	2	4	410	5	3
158524	10	2.9	11	0.64	450	<4	0.14	17	26	500	18	9	6000	100	11
158526	8	0.59	7	0.27	64	<4	0.07	<4	16	980	6	16	1400	46	6
158528	4	0.19	3	<0.05	110	<4	<0.05	<4	4	23	1	6	200	7	1
158529	90	6.4	25	1.4	890	<4	0.41	13	54	770	18	16	5700	180	33
158531	<2	0.85	6	0.66	51	<4	3.8	<4	5	450	3	24	1100	15	5
158535	20	2.0	18	0.60	210	<4	0.42	<4	11	280	11	9	1600	85	15
158540	29	4.4	26	1.1	670	<4	0.38	<4	29	880	11	13	2100	88	16
158547	3	0.10	1	<0.05	8	<4	<0.05	<4	3	27	<1	<2	160	4	1
158554	3	1.6	10	0.24	180	<4	2.1	10	5	340	3	57	1100	12	25
158570	3	0.25	1	<0.05	19	<4	<0.05	<4	5	48	1	2	110	8	1
158579	<2	0.36	3	0.07	75	<4	2.1	<4	<2	260	1	12	350	6	3
158580	<2	0.55	4	0.12	21	<4	<0.05	<4	7	120	2	15	750	14	4
158582	3	0.16	2	0.08	14	<4	<0.05	<4	2	29	1	11	410	6	2
158587	2	0.29	2	<0.05	16	<4	<0.05	<4	3	1200	2	10	440	9	6
158588	3	0.05	1	<0.05	5	<4	<0.05	<4	<2	45	1	5	220	3	1
158590	2	0.14	1	0.06	4	<4	<0.05	<4	4	83	1	8	140	7	1
158591	59	4.2	27	1.6	1000	<4	1.5	<4	74	300	12	18	2800	89	21
158592	3	0.11	2	<0.05	53	<4	<0.05	<4	3	78	1	4	290	5	1
158595	<2	<0.05	1	<0.05	<4	<4	<0.05	<4	<2	6	<1	2	<10	<2	<1
158596	3	0.18	5	<0.05	53	<4	2.7	<4	<2	150	<1	<2	40	<2	1
158598	3	1.7	11	0.33	120	<4	1.7	9	8	570	3	61	1000	20	17
158601	3	0.27	23	<0.05	300	<4	2.6	120	<2	130	4	11	160	<2	10
158615	22	0.86	7	0.18	68	17	1.8	7	27	250	6	43	730	27	10
158618	2	0.23	4	<0.05	14	<4	<0.05	<4	<2	45	1	22	400	10	5
158619	5	0.23	11	<0.05	510	<4	2.9	8	2	320	<1	5	53	<2	4
158621	5	0.19	5	<0.05	58	<4	2.7	10	2	160	1	3	200	<2	7
158625	2	0.65	9	0.13	120	<4	0.51	6	5	58	1	3	690	8	1
158632	2	1.3	14	0.29	100	<4	2.3	8	6	280	2	29	1100	12	7
158639	7	0.45	2	0.06	38	<4	<0.05	<4	7	89	1	2	490	9	1
158643	3	0.10	<1	<0.05	7	<4	<0.05	<4	4	34	<1	<2	61	5	<1
158644	<2	1.9	15	0.47	46	<4	0.12	5	15	770	2	31	1200	20	9
158645	<2	0.55	7	0.12	73	<4	2.6	4	2	120	1	6	450	4	2
158649	6	0.82	2	0.09	66	<4	<0.05	<4	7	520	3	13	910	15	6
158650	7	0.30	2	0.05	29	<4	<0.05	<4	9	91	1	9	250	8	2
158651	9	0.22	1	<0.05	13	<4	<0.05	<4	6	60	1	5	210	7	1
158652	6	0.23	1	0.08	20	<4	0.06	<4	6	140	2	79	670	13	3
158653	12	0.39	2	0.11	18	<4	<0.05	<4	8	99	1	34	520	10	2
158654	3	0.17	1	<0.05	15	<4	<0.05	<4	5	24	1	5	97	5	<1
158655	4	0.32	1	<0.05	9	<4	<0.05	<4	6	56	1	6	250	7	1

TABLE C-IX. Analyses of rock samples

b

RAFT RIVER ROCK

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)	TH/U
156740	10	<2	1.6	23	25			0.1		1.8		11.		5.4
156741	6	<2	0.64	17	17			0.2		1.6		9.4		4.4
156742	36	<2	1.9	290	25			0.3		3.0		16.		2.5
156791	4	<2	0.08	6	31	1800	10000	0.4	40	1.6	29	16.	21	7.1
156792	2	<2	0.22	9	20		7800	0.5	32	1.5	14	11.	14	2.9
156800	89	<2	1.9	140	37	4200								2.1
156807	41	4	2.6	110	180	4200								20.
156808	99	3	2.6	62	72	8400								13.
156809	10	7	0.90	25	100	4200								11.
156812	54	2	2.7	130	98									7.6
156817	20	2	4.5	110	120	5100								4.7
156850	61	2	2.3	180	150	7200								6.9
156855	51	2	2.1	170	120	4500								12.
156859	53	<2	0.88	79	70									5.0
158519	4	<2	0.59	14	<10	2900								2.9
158520	16	2	2.1	36	22									1.3
158524	28	3	4.7	110	100									1.5
158526	15	2	2.1	110	84	4200								5.7
158528	9	<2	0.35	9	<10	370								15.
158529	120	4	2.0	99	100	1800								2.3
158531	11	2	0.80	51	68	1900	8500	3.5	170	6.2	65	54.	68	10.
158535	49	3	1.7	91	64									2.7
158540	100	3	1.5	76	89	1200								3.2
158547	4	<2	0.53	21	14									1.1
158554	36	6	2.9	75	130									9.2
158570	7	<2	0.42	21	13									2.0
158579	7	2	2.6	89	43									11.
158580	5	2	1.1	11	32									12.
158582	3	2	1.3	53	32									12.
158587	2	<2	0.15	35	69									11.
158588	<2	<2	0.14	4	27									13.
158590	3	<2	0.31	3	31	0								10.
158591	84	2	1.1	120	67									7.8
158592	2	2	0.16	4	26									6.7
158595	<2	<2	0.02	<1	<10									20.
158596	13	<2	2.5	30	<10									0.42
158598	45	6	3.0	58	130									13.
158601	11	5	2.5	9	18									1.7
158615	32	15	2.2	110	140	3400								27.
158618	4	2	0.48	3	72									10.
158619	11	2	2.9	120	10	1600								0.86
158621	3	2	2.0	140	18	1600								
158625	21	<2	1.5	44	22	2200								3.3
158632	65	3	2.9	120	56									13.
158639	8	<2	0.36	9	18									2.5
158643	6	<2	0.11	23	<10									0.63
158644	18	3	2.8	28	45									7.9
158645	16	<2	3.0	110	30									3.5
158649	8	2	0.57	62	48	0								10.
158650	8	2	0.75	31	34	450								10.
158651	18	<2	0.96	21	24									8.3
158652	10	8	1.6	71	54									9.9
158653	9	3	0.64	8	37									9.7
158654	7	<2	0.22	7	<10									8.3
158655	7	2	0.33	19	18									8.6

TABLE C-IX. Analyses of rock samples

RAFT RIVER ROCK

SECTION 1 OF 3

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
158656	40-	41.926	-113.786	-3-92-	1.8	6.5	0.27	<2	7.9	<10	910	7	1.0	6	46
158671	40-	41.719	-113.728	-3-92-	1.0	2.4	0.42	<2	6.7	<10	990	1	0.85	<4	38
158672	40-	41.720	-113.724	-3-92-	2.8	3.3	0.85	<2	6.4	<10	1600	<1	0.55	<4	8
158673	40-	41.723	-113.717	-3-92-	1.2	2.4	0.49	<2	5.4	<10	530	1	0.50	18	180
158674	40-	41.726	-113.715	-3-92-	1.3	2.8	0.45	<2	7.7	<10	1000	1	1.1	<4	6
158676	40-	41.735	-113.699	-3-92-	2.9	5.5	0.52	<2	12.	11	1100	2	0.30	7	56
158677	40-	41.744	-113.686	-3-92-	0.71	0.90	0.79	<2	1.3	<10	250	<1	<0.05	<4	13
158681	40-	41.712	-113.711	-3-92-	1.6	2.6	0.63	<2	6.5	<10	1300	1	0.83	<4	26
158689	40-	41.689	-113.746	-3-92-	2.9	3.6	0.80	<2	7.4	<10	670	10	1.2	<4	9
158690	40-	41.691	-113.758	-3-92-	13.	14.	0.94	<2	7.7	<10	200	5	0.32	<4	3
158691	40-	41.692	-113.776	-3-92-		9.2									
158700	40-	41.883	-113.560	-3-92-	0.94	1.0	0.94	<2	0.46	<10	86	<1	0.09	<4	9
158701	40-	41.883	-113.560	-3-92-	0.99	1.3	0.76	<2	0.91	<10	98	<1	0.07	<4	12
158702	40-	41.883	-113.560	-3-92-	0.42	1.0	0.42	<2	0.96	<10	79	<1	<0.05	<4	12
158703	40-	41.883	-113.560	-3-92-	1.5	2.0	0.77	<2	2.7	<10	250	1	<0.05	<4	20
158704	40-	41.894	-113.550	-3-92-	1.8	3.4	0.54	<2	8.4	<10	600	3	1.0	11	180
158705	40-	41.907	-113.559	-3-92-	1.0	1.5	0.67	<2	3.2	<10	430	1	0.05	6	41
158706	40-	41.920	-113.563	-3-92-	1.6	2.2	0.73	<2	4.2	<10	220	2	0.79	8	54
158709	40-	42.080	-113.669	-3-92-	2.4	3.8	0.62	<2	0.90	11	37	<1	0.05	<4	29
158710	40-	42.080	-113.669	-3-92-	1.4	1.7	0.83	<2	0.54	11	35	<1	<0.05	<4	19
158711	40-	42.080	-113.669	-3-92-	1.0	1.2	0.87	<2	1.6	<10	66	<1	<0.05	<4	38
158713	40-	41.816	-113.618	-3-92-	2.8	2.9	0.96	<2	6.4	<10	950	1	0.51	<4	6
158714	40-	41.816	-113.618	-3-92-	0.81	2.5	0.32	<2	7.2	20	850	2	0.14	5	44
158715	40-	41.816	-113.618	-3-92-	4.7	7.1	0.66	19	8.0	13	780	2	0.20	6	26
158716	40-	41.816	-113.618	-3-92-	0.78	0.70	1.1	<2	0.61	<10	37	<1	<0.05	<4	11
158721	40-	41.858	-113.487	-3-92-	2.9	5.4	0.54	<2	7.3	<10	610	2	0.33	<4	6
158722	40-	41.852	-113.644	-3-92-	<0.25	0.50	0.25	<2	1.0	<10	150	<1	<0.05	<4	19
158724	40-	41.859	-113.661	-3-92-	0.57	0.90	0.63	<2	1.5	12	220	1	<0.05	<4	9
158725	40-	41.854	-113.487	-3-92-	0.64	1.3	0.49	<2	2.4	13	140	<1	<0.05	<4	18
158726	40-	41.854	-113.487	-3-92-	0.46	0.60	0.77	<2	0.90	<10	38	<1	<0.05	<4	8
158727	40-	41.854	-113.487	-3-92-	0.32	0.80	0.40	<2	1.2	<10	52	<1	<0.05	<4	9
158728	40-	41.854	-113.487	-3-92-	0.35	0.70	0.50	<2	1.2	<10	51	<1	<0.05	<4	7
158729	40-	41.854	-113.487	-3-92-	0.58	1.0	0.58	<2	1.2	<10	79	<1	<0.05	<4	26
158730	40-	41.854	-113.487	-3-92-	0.53	1.0	0.53	<2	1.2	<10	110	<1	<0.05	<4	28
158731	40-	41.854	-113.487	-3-92-	1.5	1.7	0.86	<2	2.0	14	71	<1	0.05	<4	7
158734	40-	41.936	-113.268	-3-92-	4.8	4.8	1.0	<2	5.6	<10	810	2	0.83	4	27
158738	40-	41.952	-113.264	-3-92-	3.0	3.8	0.79	<2	6.7	<10	290	1	0.42	5	74
158741	40-	41.936	-113.280	-3-92-	1.6	2.2	0.72	<2	8.2	<10	400	1	1.1	15	110
158743	40-	41.958	-113.270	-3-92-	0.60	0.70	0.86	<2	0.40	<10	55	<1	0.08	<4	18
158744	40-	41.957	-113.356	-3-92-	2.0	3.9	0.52	<2	1.1	<10	170	<1	0.12	<4	27
158745	40-	41.957	-113.354	-3-92-	1.1	0.80	1.3	<2	1.1	<10	95	<1	0.07	<4	17
158746	40-	41.906	-113.355	-3-92-	2.1	2.6	0.83	<2	7.3	<10	120	3	0.37	<4	6
158747	40-	41.956	-113.357	-3-92-	2.1	2.4	0.86	<2	6.8	<10	550	2	1.4	16	210
158748	40-	41.895	-113.201	-3-92-	2.7	6.2	0.44	<2	8.1	<10	1100	7	0.65	5	38
158749	40-	41.895	-113.201	-3-92-	0.76	1.4	0.54	<2	1.3	<10	110	<1	<0.05	<4	15
158750	40-	41.895	-113.201	-3-92-	1.5	2.6	0.58	<2	7.3	<10	430	2	1.3	21	250
158751	40-	41.771	-113.700	-3-92-											
158915	40-	42.319	-113.603	-3-92-	0.28	0.50	0.56	<2	0.19	<10	19	<1	<0.05	<4	7
158916	40-	42.302	-113.552	-3-92-	11.	14.	0.77	<2	6.5	<10	1200	4	0.81	4	13
158917	40-	42.302	-113.552	-3-92-	3.7	6.3	0.58	<2	1.3	<10	93	1	0.32	<4	210
158918	40-	42.299	-113.554	-3-92-	2.9	2.6	1.1	<2	6.7	<10	430	2	0.76	22	220
158919	40-	42.223	-113.602	-3-92-	6.6	9.5	0.69	<2	6.3	<10	590	4	0.69	<4	30
158920	40-	42.223	-113.601	-3-92-	1.0	4.2	0.24	<2	7.8	<10	520	3	1.3	21	230
158921	40-	42.111	-113.508	-3-92-	0.39	1.0	0.39	<2	0.66	<10	42	<1	<0.05	<4	8
158922	40-	42.128	-114.250	-3-92-	0.73	0.70	1.0	<2	0.43	<10	82	<1	<0.05	<4	11

TABLE C-IX. Analyses of rock samples

RAFT RIVER ROCK

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
158656	17	5.4	42	1.0	830	<4	2.5	200	20	1500	10	17	7600	73	20
158671	4	1.3	14	0.24	180	<4	2.5	7	3	220	2	21	1100	11	5
158672	9	0.91	9	0.11	150	<4	2.1	<4	2	180	3	32	560	5	5
158673	4	5.6	42	1.6	510	<4	0.93	<4	70	210	12	17	3400	100	9
158674	9	1.4	10	0.42	200	<4	2.7	9	17	170	3	44	1100	11	8
158676	5	3.3	26	1.0	160	<4	0.46	10	49	390	10	51	2100	39	34
158677	3	0.60	3	0.07	14	<4	<0.05	<4	4	110	1	2	770	19	2
158681	15	0.86	10	0.15	110	<4	2.0	5	4	150	2	37	620	8	9
158689	30	1.3	45	0.31	310	<4	2.5	6	6	150	3	16	880	12	3
158690	12	0.45	17	<0.05	190	5	2.2	37	14	80	5	11	170	3	10
158691															
158700	4	0.44	2	<0.05	330	<4	<0.05	<4	3	430	1	2	260	7	3
158701	4	0.16	2	0.07	8	<4	<0.05	<4	6	300	1	4	240	9	2
158702	3	0.13	1	0.05	5	<4	<0.05	<4	4	53	1	3	150	6	1
158703	4	0.76	7	0.25	26	<4	<0.05	<4	9	110	2	7	660	14	1
158704	28	5.0	39	1.8	1000	<4	1.2	28	44	960	15	15	3900	120	17
158705	5	1.9	12	0.36	210	<4	0.38	4	17	160	4	9	2200	37	4
158706	17	2.6	15	0.82	580	<4	1.2	33	32	610	6	5	3800	58	22
158709	3	0.94	2	<0.05	12	<4	<0.05	<4	4	220	2	51	1000	23	4
158710	4	0.55	2	<0.05	17	<4	<0.05	<4	4	120	1	37	520	14	2
158711	3	0.71	3	0.07	9	<4	<0.05	<4	7	120	2	12	730	22	1
158713	2	0.71	5	0.11	58	<4	1.9	5	2	240	2	24	750	8	12
158714	4	2.4	19	0.61	95	<4	0.32	5	19	350	7	23	2000	40	9
158715	6	3.0	15	0.69	110	<4	0.19	5	33	410	9	35	1700	40	12
158716	3	0.13	1	<0.05	6	<4	<0.05	<4	4	27	<1	<2	80	4	<1
158721	5	1.0	7	0.22	120	<4	2.6	12	12	320	4	43	830	9	31
158722	7	0.31	1	<0.05	11	<4	<0.05	<4	7	39	1	4	230	5	1
158724	10	0.40	3	0.09	19	<4	<0.05	<4	3	51	1	<2	420	8	1
158725	4	0.27	2	0.10	11	<4	<0.05	<4	4	77	1	16	260	5	1
158726	4	0.18	<1	<0.05	17	<4	<0.05	<4	3	36	<1	<2	110	<2	<1
158727	4	0.15	<1	<0.05	16	<4	<0.05	<4	5	32	<1	<2	68	4	<1
158728	3	0.18	1	<0.05	10	<4	<0.05	<4	4	30	<1	<2	89	4	<1
158729	4	0.23	1	0.05	15	<4	<0.05	<4	2	54	<1	<2	99	2	<1
158730	2	0.25	1	0.06	25	<4	<0.05	<4	4	110	<1	4	97	5	<1
158731	8	0.45	3	0.15	75	<4	<0.05	<4	6	150	1	34	240	6	2
158734	11	1.1	12	0.39	140	<4	2.1	7	13	370	3	29	1400	24	17
158738	29	1.9	10	0.63	180	<4	2.8	22	24	640	7	7	980	32	6
158741	9	3.9	15	1.4	530	<4	1.5	10	75	480	15	5	2200	85	7
158743	10	0.28	3	<0.05	32	<4	<0.05	<4	5	90	<1	<2	110	23	1
158744	7	0.19	1	0.05	23	<4	<0.05	<4	4	250	2	49	760	14	2
158745	5	0.25	1	<0.05	35	<4	0.07	<4	5	160	1	3	340	5	1
158746	6	0.55	4	0.16	110	<4	3.9	5	4	180	2	6	150	2	5
158747	11	4.8	27	2.0	530	<4	1.4	<4	100	590	14	8	3500	110	14
158748	64	4.9	8	0.82	530	<4	4.0	200	16	1700	8	30	7000	66	38
158749	3	0.09	1	<0.05	6	<4	<0.05	<4	3	73	1	10	240	11	<1
158750	67	5.2	32	2.0	540	<4	2.1	<4	99	530	15	6	3700	130	10
158751															
158915	2	0.10	<1	<0.05	8	<4	<0.05	<4	<2	15	<1	<2	73	2	<1
158916	15	1.6	18	0.32	210	<4	2.0	11	7	340	4	45	1500	19	18
158917	3	0.28	4	0.15	34	<4	<0.05	<4	3	1600	2	72	770	24	10
158918	52	7.1	26	2.1	780	<4	1.1	<4	53	420	19	6	5100	180	13
158919	10	2.0	20	0.45	240	<4	2.2	22	17	610	5	31	1900	26	22
158920	23	5.2	41	1.8	700	<4	1.9	<4	92	580	15	13	3600	120	20
158921	<2	0.17	9	<0.05	19	<4	<0.05	<4	<2	35	1	5	380	6	1
158922	6	0.23	1	<0.05	15	<4	<0.05	<4	3	36	1	5	130	3	1

TABLE C-IX. Analyses of rock samples

RAFT RIVER ROCK

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPU (CPM)	ETH (PPM)	CPTH (CPM)	TH/U
158656	170	<2	2.3	270	140	0								2.6
158671	31	<2	2.6	100	52	2400								8.8
158672	25	3	2.3	120	80	6300								9.7
158673	130	<2	2.5	48	48	4500								7.1
158674	41	4	1.3	110	110	5300								16.
158676	37	5	3.8	63	110	6900								9.3
158677	4	<2	0.95	20	21	450								2.2
158681	28	3	2.8	110	81									14.
158689	57	2	1.7	140	35									4.4
158690	21	3	3.0	21	13									0.81
158691						1800								
158700	3	<2	0.22	12	44	0								2.0
158701	2	2	0.54	9	20	0								3.1
158702	2	<2	0.39	17	17	0								3.0
158703	14	<2	1.5	17	19	0								3.5
158704	88	2	1.2	140	96	3400								4.4
158705	42	<2	1.1	25	39	2600								6.0
158706	60	<2	0.64	93	81	990								2.3
158709	5	4	0.42	15	110	1800								13.
158710	2	3	0.24	8	55	1400								22.
158711	3	<2	0.70	16	26	990								10.
158713	21	3	3.0	76	69	5400								8.3
158714	24	3	3.6	37	98	5400								9.2
158715	30	4	3.1	49	79	4600								4.9
158716	5	<2	0.25	5	11	590								1.4
158721	25	6	2.4	88	140									8.0
158722	3	<2	0.51	9	10	590								8.0
158724	6	<2	0.78	25	<10	590								1.1
158725	4	2	1.2	9	50									12.
158726	2	<2	0.37	5	<10									1.7
158727	2	<2	0.46	8	<10									1.3
158728	2	<2	0.46	9	<10									1.4
158729	3	<2	0.51	9	<10									1.0
158730	3	<2	0.49	25	<10									4.0
158731	4	3	0.81	16	89									20.
158734	19	3	1.8	160	85									6.0
158738	23	<2	1.4	55	<10									1.8
158741	96	<2	1.8	45	19									2.3
158743	6	<2	0.16	6	<10									1.4
158744	3	5	0.87	17	55									13.
158745	7	<2	0.58	14	10									3.8
158746	11	<2	1.9	64	<10									2.3
158747	75	<2	1.3	160	33									3.3
158748	86	8	2.7	240	290	4600								4.8
158749	5	<2	0.67	33	32	990								7.1
158750	85	<2	1.2	140	27	1800								2.3
158751														
158915	3	<2	0.04	4	<10		6500	0.7	37	1.8	15	11.	14	2.0
158916	32	4	2.8	150	110		10000	3.7	220	21.	110	50.	65	3.2
158917	6	7	0.72	17	140		8400	1.5	99	5.2	56	47.	59	11.
158918	130	<2	1.2	76	<10		7300	1.6	73	4.4	24	12.	15	2.3
158919	39	4	2.7	95	87		12000	4.9	260	14.	110	78.	99	3.3
158920	110	<2	2.1	110	33		8800	3.2	140	7.2	40	20.	26	3.1
158921	4	<2	0.32	4	14		9000	0.6	33	2.9	16	7.7	10	5.0
158922	3	2	0.29	10	14		7100	1.0	47	1.6	17	14.	18	7.1

TABLE C-IX. Analyses of rock samples

RAFT RIVER ROCK

SECTION 1 OF 3

OR SAMPLE NUMBER	D. G. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)	CA (%)	CO (PPM)	CR (PPM)
158923	40-42.250	-113.689	-3-92-	0.93	1.7	0.55	<2	0.89	<10	260	1	0.27	<4	17
158924	40-42.222	-113.676	-3-92-	2.7	8.7	0.31	<2	1.7	<10	520	1	<0.05	<4	48
158925	40-42.124	-113.483	-3-92-	0.75	1.0	0.75	<2	0.49	<10	77	<1	0.12	<4	12
158926	40-42.122	-113.483	-3-92-	1.6	3.6	0.46	<2	7.1	25	520	3	0.18	5	89
158927	40-42.175	-113.730	-3-92-	0.57	0.40	1.4	<2	1.3	<10	51	<1	<0.05	<4	100
158928	40-42.182	-113.705	-3-92-	2.1	3.8	0.56	<2	8.9	<10	580	3	0.50	4	110
158929	40-42.049	-113.748	-3-92-	0.35	0.60	0.58	<2	1.6	<10	540	<1	<0.05	<4	11
158930	40-42.048	-113.456	-3-92-	2.4	5.0	0.47	<2	7.6	20	990	4	0.12	8	84
158931	40-42.032	-113.735	-3-92-	0.95	1.4	0.68	<2	0.88	<10	180	<1	<0.05	<4	46
158932	40-41.992	-113.716	-3-92-	1.5	2.3	0.64	<2	6.2	<10	380	3	1.0	14	170
158933	40-42.021	-113.684	-3-92-	0.25	0.70	0.36	<2	0.52	<10	85	<1	<0.05	<4	9
158934	40-42.039	-113.671	-3-92-	0.50	0.80	0.63	<2	0.70	<10	180	<1	0.12	<4	11
158935	40-42.107	-113.629	-3-92-	0.75	1.2	0.63	<2	2.9	10	390	1	0.31	<4	33
158936	40-42.107	-113.628	-3-92-	2.4	4.3	0.56	<2	6.8	<10	790	5	2.8	5	25
158937	40-41.921	-113.440	-3-92-	1.9	5.4	0.35	<2	5.0	<10	720	2	0.47	8	43
158938	40-41.921	-113.419	-3-92-	0.78	1.2	0.65	<2	4.2	<10	670	1	0.05	5	55
158939	40-41.935	-113.403	-3-92-	2.5	5.3	0.47	<2	5.5	<10	960	3	0.44	8	62
158940	40-41.954	-113.375	-3-92-	0.69	1.1	0.63	<2	1.3	<10	180	<1	0.05	<4	44
158941	40-41.901	-113.442	-3-92-	0.43	0.50	0.86	<2	0.31	<10	54	<1	0.06	<4	14
158959	40-41.000	-113.000	-3-92-	<0.25	0.70	0.18	<2	0.62	<10	72	<1	<0.05	<4	12
158960	40-41.885	-113.664	-3-92-	0.50	0.80	0.63	<2	1.4	<10	48	<1	0.06	<4	12
158961	40-41.904	-113.616	-3-92-	1.2	1.2	1.0	<2	0.61	<10	64	<1	<0.05	<4	10
158962	40-41.905	-113.615	-3-92-	0.59	1.4	0.42	<2	1.6	11	160	<1	<0.05	<4	29
158986	40-41.980	-113.324	-3-92-	1.8	4.3	0.41	<2	3.7	<10	670	1	0.20	7	24
158987	40-42.245	-113.711	-3-92-	2.6	3.2	0.82	<2	9.4	22	420	2	0.40	4	110
158988	40-41.951	-113.325	-3-92-	3.4	4.6	0.73	<2	6.9	<10	820	3	0.58	<4	3
158989	40-41.901	-113.350	-3-92-	0.34	0.70	0.49	<2	0.28	<10	42	<1	<0.05	<4	18
158990	40-41.954	-113.349	-3-92-	4.5	5.1	0.89	<2	6.8	<10	810	3	0.56	<4	9
158991	40-41.951	-113.349	-3-92-	10.0	15.	0.67	<2	1.5	<10	200	1	<0.05	<4	54
158992	40-41.951	-113.175	-3-92-	2.8	3.0	0.95	<2	9.3	<10	540	2	1.5	28	220
158995	40-41.967	-113.302	-3-92-	1.6	6.3	0.25	<2	6.7	23	810	1	0.19	5	62
158996	40-41.983	-113.304	-3-92-	0.93	1.4	0.66	<2	1.8	<10	230	1	0.09	<4	20
158997	40-41.969	-113.330	-3-92-	9.6	13.	0.71	<2	1.8	12	160	<1	0.06	<4	54
158998	40-41.991	-113.354	-3-92-	2.4	7.2	0.33	<2	7.4	36	530	4	0.70	8	53
158999	40-42.292	-113.529	-3-92-	0.65	0.70	0.93	<2	0.46	<10	68	<1	0.12	4	13
159000	40-42.209	-113.597	-3-92-	0.25	0.70	0.36	<2	0.29	<10	130	<1	<0.05	<4	12
159001	40-42.178	-113.612	-3-92-	<0.25	0.70	0.18	<2	0.52	<10	43	<1	<0.05	<4	14
159002	40-42.243	-113.666	-3-92-	0.30	0.40	0.75	<2	0.56	<10	40	<1	<0.05	<4	20
159003	40-******	-*******	-3-92-	0.90	1.6	0.56	<2	6.6	<10	830	1	0.87	19	190
159004	40-42.026	-113.745	-3-92-	0.35	0.60	0.58	<2	0.44	<10	20	<1	<0.05	<4	6
159005	40-41.960	-113.281	-3-92-	1.9	2.5	0.76	<2	7.9	<10	690	2	1.3	29	240
159006	40-41.960	-113.279	-3-92-	<0.25	0.60	0.21	<2	0.20	<10	25	<1	<0.05	<4	12
159007	40-41.919	-113.481	-3-92-	1.4	3.0	0.48	<2	1.3	<10	210	1	0.29	<4	27
159008	40-41.921	-113.483	-3-92-	2.2	5.4	0.41	<2	8.9	26	990	3	0.16	6	70
159009	40-42.113	-113.468	-3-92-	3.1	6.3	0.50	<2	8.3	16	720	5	0.87	9	69
159010	40-42.107	-113.476	-3-92-	2.4	3.0	0.80	<2	0.68	<10	64	<1	<0.05	<4	80
159011	40-42.088	-113.455	-3-92-	0.76	0.60	1.3	<2	1.2	<10	44	<1	<0.05	<4	7
159012	40-42.226	-113.699	-3-92-	0.39	0.60	0.65	<2	0.34	<10	40	<1	<0.05	4	9

TABLE C-IX. Analyses of rock samples

5-a

RAFT RIVER ROCK

SECTION 2 OF 3

OR SAMPLE NUMBER	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)	TI (PPM)	V (PPM)	Y (PPM)
158923	3	0.55	3	0.12	72	<4	<0.05	<4	5	1300	3	7	810	16	10
158924	3	1.3	2	0.09	590	<4	<0.05	<4	7	620	3	25	2500	28	6
158925	8	0.33	5	<0.05	23	<4	<0.05	<4	6	500	2	10	430	9	6
158926	18	1.3	25	0.55	39	<4	0.13	<4	23	480	12	19	3600	84	17
158927	3	0.14	1	<0.05	8	<4	<0.05	<4	4	33	1	2	220	7	1
158928	35	4.1	16	1.2	560	<4	1.4	12	19	820	13	18	5900	92	7
158929	2	0.06	6	<0.05	9	<4	0.08	<4	2	76	1	3	83	3	1
158930	7	4.6	14	0.56	280	<4	0.15	8	23	740	13	11	4400	72	9
158931	4	0.16	7	<0.05	15	<4	<0.05	<4	5	83	1	15	300	7	4
158932	54	5.1	16	1.7	680	<4	1.3	5	43	370	12	12	3500	110	13
158933	7	0.28	1	<0.05	14	<4	<0.05	<4	15	26	<1	2	150	5	1
158934	4	0.21	2	0.05	65	<4	<0.05	<4	3	130	1	2	450	6	3
158935	17	1.5	11	0.40	160	4	0.23	<4	15	270	4	11	1200	30	8
158936	23	6.0	22	0.89	1600	6	2.6	120	17	1200	10	15	7300	100	48
158937	15	5.6	18	1.1	270	<4	0.05	5	18	2400	10	18	2600	54	14
158938	4	1.8	16	0.58	300	<4	0.41	<4	23	200	5	8	1500	24	2
158939	5	4.7	21	0.65	250	<4	0.11	7	20	1700	9	15	2900	55	11
158940	13	0.47	1	0.05	24	<4	<0.05	<4	8	200	1	15	320	13	1
158941	4	0.12	1	<0.05	11	<4	<0.05	<4	4	220	1	<2	300	4	2
158959	4	0.14	2	<0.05	8	<4	<0.05	<4	4	43	1	5	120	5	1
158960	3	0.14	<1	<0.05	15	<4	<0.05	<4	3	210	<1	4	110	5	1
158961	4	0.17	3	0.06	51	<4	<0.05	<4	4	76	<1	<2	140	5	1
158962	10	0.56	5	0.12	28	<4	<0.05	<4	10	130	3	9	690	20	1
158986	8	1.8	9	0.35	170	<4	0.09	8	13	770	5	14	2400	28	6
158987	4	2.8	26	0.89	230	<4	0.66	<4	40	610	17	16	4000	130	29
158988	2	1.2	14	0.16	230	<4	2.6	18	3	350	3	52	1200	11	24
158989	5	0.16	1	<0.05	11	<4	<0.05	<4	3	75	1	7	440	7	1
158990	4	1.4	13	0.18	220	<4	1.9	16	3	410	3	50	1100	11	23
158991	7	0.20	1	0.05	16	<4	<0.05	4	6	260	3	230	1600	23	9
158992	77	6.6	32	3.0	910	<4	1.5	<4	130	1200	18	8	3900	150	19
158995	4	2.1	7	0.35	400	<4	0.10	11	14	720	9	13	4300	63	5
158996	8	0.39	3	0.10	53	<4	<0.05	<4	6	340	3	<2	590	20	2
158997	7	0.27	2	0.08	18	<4	<0.05	<4	4	180	2	100	1200	29	3
158998	4	3.3	20	0.47	87	<4	0.13	14	19	3200	11	9	3700	72	14
158999	5	0.33	1	<0.05	52	<4	<0.05	<4	5	310	2	4	180	10	3
159000	3	0.43	1	<0.05	21	<4	<0.05	<4	3	96	1	<2	150	8	1
159001	9	0.35	1	<0.05	21	<4	<0.05	<4	6	15	<1	<2	120	3	1
159002	4	0.14	1	<0.05	19	<4	<0.05	<4	3	66	<1	2	78	5	1
159003	21	5.5	55	1.9	620	<4	1.1	5	68	150	15	14	4800	140	9
159004	13	0.11	2	<0.05	9	<4	<0.05	<4	2	41	<1	5	75	3	1
159005	14	6.5	24	2.6	650	<4	0.75	<4	130	460	19	5	3900	150	18
159006	4	0.14	1	<0.05	9	<4	<0.05	<4	3	39	<1	4	91	6	1
159007	7	0.42	4	0.15	23	<4	<0.05	<4	5	1400	4	12	740	23	11
159008	12	2.8	13	0.60	210	<4	0.08	13	21	760	12	21	3700	63	6
159009	4	4.0	21	0.71	220	<4	0.16	16	19	3700	15	24	5000	77	75
159010	5	0.38	7	0.06	27	<4	<0.05	<4	5	130	1	33	870	11	3
159011	3	0.20	3	<0.05	26	<4	<0.05	<4	2	40	1	3	310	6	1
159012	6	0.30	1	0.05	69	<4	<0.05	<4	5	72	1	5	170	7	2

TABLE C-IX. Analyses of rock samples

5-b

RAFT RIVER ROCK

SECTION 3 OF 3

OR SAMPLE NUMBER	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)	TGAM (CPS)	TOT (CPM)	EK (%)	CPK (CPM)	EU (PPM)	CPL (CPM)	ETH (PPM)	CPTH (CPM)	TH/U
158923	6	3	0.62	100	57		7500	1.1	56	2.7	22	16.	20	4.1
158924	9	5	1.5	54	110		9600	2.3	120	6.7	46	29.	37	2.9
158925	5	<2	0.32	10	35		9800	0.5	38	3.7	24	14.	18	10.
158926	12	3	3.6	62	100		10000	5.1	210	5.7	52	25.	32	5.3
158927	2	<2	0.54	4	<10		9000	1.0	44	2.1	14	8.6	11	5.0
158928	76	<2	2.1	130	110		9200	1.6	99	8.1	52	30.	39	4.7
158929	<2	2	1.7	100	26		8600	2.3	100	4.1	31	21.	27	5.0
158930	25	<2	4.5	180	77		8700	5.0	220	8.4	59	39.	49	2.2
158931	2	3	0.74	23	31		6900	0.7	35	2.1	12	6.2	8	11.
158932	81	<2	1.5	76	48		7300	2.2	95	2.6	28	24.	30	5.2
158933	6	<2	0.30	19	<10									2.9
158934	4	2	0.60	24	13									2.5
158935	16	3	1.3	46	34									9.2
158936	150	9	1.3	280	200									3.5
158937	39	2	2.9	70	120		7200	3.4	140	4.9	36	25.	31	3.3
158938	39	<2	1.4	27	29		8200	1.1	52	3.2	18	8.5	11	6.7
158939	53	<2	3.5	150	72		10000	7.7	220	5.5	54	29.	37	2.8
158940	3	2	0.93	15	40		8600	2.7	120	4.2	30	20.	25	14.
158941	2	<2	0.20	9	21		830	0.3	2	3.0	1	3.7	0	2.0
158959	4	2	0.29	6	15		7400	0.4	24	1.8	11	6.2	8	7.1
158960	4	<2	0.57	23	13		8300	1.3	60	3.0	19	11.	14	5.0
158961	3	<2	0.31	4	<10		5700	0.6	35	2.9	16	7.7	10	0.83
158962	4	<2	0.97	10	13		7900	2.1	88	3.0	24	17.	22	6.4
158986	11	2	2.8	98	79		10000	3.4	160	8.1	51	300.	36	3.3
158987	18	2	2.1	490	100		18000	0.2	49	10.	45	13.	18	5.0
158988	33	5	2.9	81	150		8500	5.5	250	5.4	82	78.	98	11.
158989	2	<2	0.16	4	16		7100	0.8	38	2.5	14	7.0	9	10.
158990	30	6	3.6	62	130		9700	4.3	210	6.5	61	64.	81	9.8
158991	20	20	1.3	19	180		12000	1.9	220	14.	180	150.	190	16.
158992	140	<2	1.1	150	40		7800	3.2	140	5.7	40	26.	33	2.7
158995	14	3	3.5	230	77		8700	5.4	230	10.	56	31.	39	2.1
158996	5	<2	1.4	34	44		7500	1.7	72	3.0	20	13.	16	0.71
158997	4	11	1.3	12	77		10000	1.6	120	12.	75	41.	53	7.7
158998	20	2	3.9	230	73		10000	4.6	200	6.5	54	32.	41	1.3
158999	2	<2	0.28	12	24		9300	0.3	25	3.7	18	6.8	5	5.7
159000	4	<2	0.18	8	<10		12000	0.3	21	2.6	13	5.3	7	1.4
159001	5	2	0.21	9	13		10000	0.2	33	6.3	27	7.3	10	1.4
159002	5	<2	0.20	14	12		12000	0.3	13	0.3	5	4.8	6	5.0
159003	120	<2	2.3	82	66		15000	0.7	74	11.	55	21.	28	8.8
159004	5	<2	0.17	19	17		14000	0.2	19	2.3	12	5.4	7	8.3
159005	92	<2	1.2	80	42		16000	0.0	10	2.3	10	2.9	4	2.0
159006	3	<2	0.08	2	20		20000	0.2	49	11.	46	12.	16	6.7
159007	6	2	0.89	58	120		19000	0.0	30	7.7	31	6.3	9	4.0
159008	29	3	4.2	94	74		18000	0.7	87	17.	68	14.	20	3.9
159009	28	3	4.5	170	210		18000	0.9	94	17.	68	14.	20	3.8
159010	4	3	0.34	3	42		16000	0.3	25	2.9	16	7.7	10	11.
159011	4	<2	0.40	18	16		15000	0.1	16	2.4	13	6.1	8	5.0
159012	8	<2	0.15	4	24		19000	0.0	12	2.1	13	6.9	9	8.3

TABLE C-IX. Analyses of rock samples

SAMPLE NUMBER	GEO. CODE	SAMPLE NUMBER	GEO. CODE	SAMPLE NUMBER	GEO. CODE	SAMPLE NUMBER	GEO. CODE
154440	UKQD	156594	PЄUN	158691	PЄTR	159007	PЄEQ
154455	PЄEQ	156601	XUNS	158700	PЄYQ	159008	PЄES
154456	PЄMI	156602	XEQZ	158701	PЄYQ	159009	WGSH
154457	PЄTR	156646	PЄUN	158702	PЄYQ	159010	PЄEQ
154490	XEQZ	156675	PЄUN	158703	PЄYQ	159011	PЄEQ
154498	XUNS	156680	PЄYQ	158704	PЄSS	159012	PЄEQ
154511	PЄSS	156684	PЄSS	158705	ЄCBQ		
154512	PЄEC	156698	PЄEQ	158706	PЄSS		
154514	PЄEQ	156699	PЄES	158709	PЄEC		
154517	PЄEQ	156700	PЄES	158710	PЄEC		
154523	PЄYQ	156707	WGAD	158711	PЄEQ		
154524	PЄUN	156709	WGAD	158713	PЄAD		
154525	PЄUN	156710	WGAD	158714	PЄOS		
154526	PЄSS	156719	PЄEC	158715	PЄOS		
154529	PЄSS	156720	PЄEC	158716	PЄEQ		
154532	PЄYQ	156724	WGAD	158721	PЄAD		
154533	PЄYQ	156730	ZHSQ	158722	PЄYQ		
154534	PЄAD	156731	XUNS	158724	PЄYQ		
154535	PЄSS	156738	PЄEQ	158725	PЄEQ		
154536	ЄCBQ	156739	PЄEQ	158726	PЄEQ		
154537	ЄCBQ	156740	PЄEQ	158727	PЄEQ		
154539	ЄCBQ	156741	PЄEQ	158728	PЄEQ		
154542	ЄCBQ	156742	PЄEQ	158729	PЄEQ		
154547	PЄAD	156791	PЄEQ	158730	PЄEQ		
154550	QAGT	156792	PЄEQ	158731	PЄEQ		
154551	PЄEQ	156800	WGSH	158734	PЄOS		
154552	PЄAD	156807	WGGN	158738	PЄOT		
154553	PЄUN	156808	WGGS	158741	PЄOT		
154554	PЄYQ	156809	PЄEC	158743	PЄEQ		
154555	PЄES	156812	PЄAD	158744	PЄEC		
154561	PЄUN	156817	PЄUN	158745	PЄEQ		
154566	PЄEQ	156850	WGGN	158746	PЄAD		
154568	PЄEQ	156855	WGAD	158747	PЄOS		
154581	PЄAG	156859	PЄES	158748	PЄEQ		
154587	ЄCBQ	158519	ЄCBQ	158749	PЄEQ		
154589	PO	158520	ЄCBQ	158750	PЄOS		
154596	ЄCBQ	158524	PЄUN	158915	XEQZ		
154601	ЄCBQ	158526	PЄEQ	158916	WGGN		
154607	XUNS	158528	PЄYQ	158917	XEPC		
154609	XUNS	158529	PЄYS	158918	WGSH		
154612	XUNS	158531	PЄAD	158919	WGGN		
154614	XUNS	158535	PЄSS	158920	WGSH		
154718	PЄEQ	158540	PЄSS	158921	PЄEQ		
154719	PЄOS	158547	PЄEQ	158922	PЄEQ		
154720	PЄEQ	158554	PЄAD	158923	PЄEQ		
154721	PЄEQ	158559	PЄAD	158924	PЄEQ		
154722	PЄOS	158570	PЄEQ	158925	PЄEQ		
154723	PЄOS	158579	PЄAD	158926	PЄES		
154724	PЄEQ	158580	PЄEC	158927	ЄYQ		
154725	OP	158582	PЄEQ	158928	WGSH		
154726	OP	158587	PЄEQ	158929	PЄEQ		
154727	PЄES	158588	PЄEQ	158930	WGSH		
154728	PЄEQ	158590	PЄEQ	158931	PЄEQ		
154734	PЄEQ	158591	PЄOS	158932	PЄOS		
154739	PЄEQ	158592	PЄEC	158933	PЄEQ		
154743	PЄEQ	158595	ЄCBQ	158934	PЄEQ		
154745	PЄES	158596	PЄAD	158935	PЄEQ		
154748	PЄOS	158598	PЄOS	158936	PЄES		
154823	WGGN	158601	PЄAD	158937	PЄES		
154828	WGAD	158615	PЄAD	158938	PЄUN		
154836	XUNS	158618	ЄCBQ	158939	PЄES		
154859	WGAD	158619	PЄAD	158940	PЄEQ		
154878	PЄAG	158621	ЄCBQ	158941	PЄEQ		
154884	PЄEQ	158625	ЄCBQ	158959	PЄEQ		
154887	PЄEQ	158632	PЄSS	158960	PЄYQ		
154888	PЄEQ	158639	PЄEQ	158961	PЄYQ		
154889	WGAD	158643	PЄEQ	158962	PЄYQ		
154890	PЄEQ	158644	PЄSS	158986	PЄES		
154919	PЄAG	158645	PЄAD	158987	ЄMP		
156401	TAP	158649	XEQZ	158988	PЄTR		
156405	WGSH	158650	XEQZ	158989	PЄEQ		
156407	PЄEQ	158651	XEQZ	158990	PЄAD		
156408	PЄEQ	158652	XEQZ	158991	PЄEC		
156409	ЄNS	158653	XEQZ	158992	PЄOS		
156411	XEQZ	185654	XEQZ	158995	PЄES		
156412	WGAD	158655	PЄYQ	158996	PЄEQ		
156413	ZHSQ	158656	PЄSS	158997	PЄEC		
156414	XUNS	158671	PЄAG	158998	PЄES		
156415	XEQZ	158672	PЄAG	158999	XEQZ		
156416	XUNS	158673	PЄAS	159000	PЄEQ		
156420	TAP	158674	PЄAG	159001	PЄEQ		
156425	PЄEQ	158676	PЄSS	159002	PЄEQ		
156426	PЄEC	158677	PЄSS	159003	WGGN		
156468	ЄCBQ	158681	PЄAG	159004	PЄEQ		
156471	PЄYQ	158689	ЄCBQ	159005	PЄOS		
156472	PЄSS	158690	PЄAD	159006	PЄEQ		

TABLE C-X. Geologic unit code index for rock samples

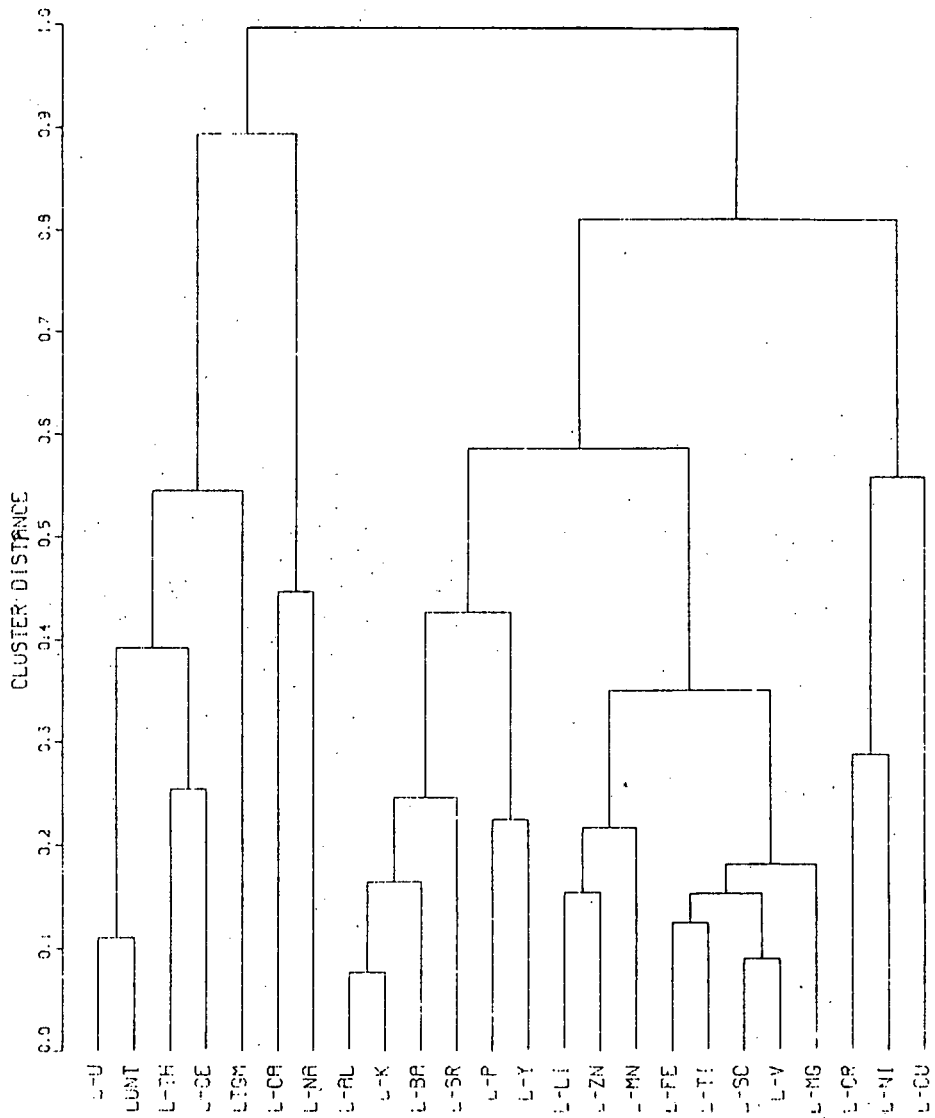


Figure C-1. Cluster analysis (dendrogram) of correlation matrix for rock samples

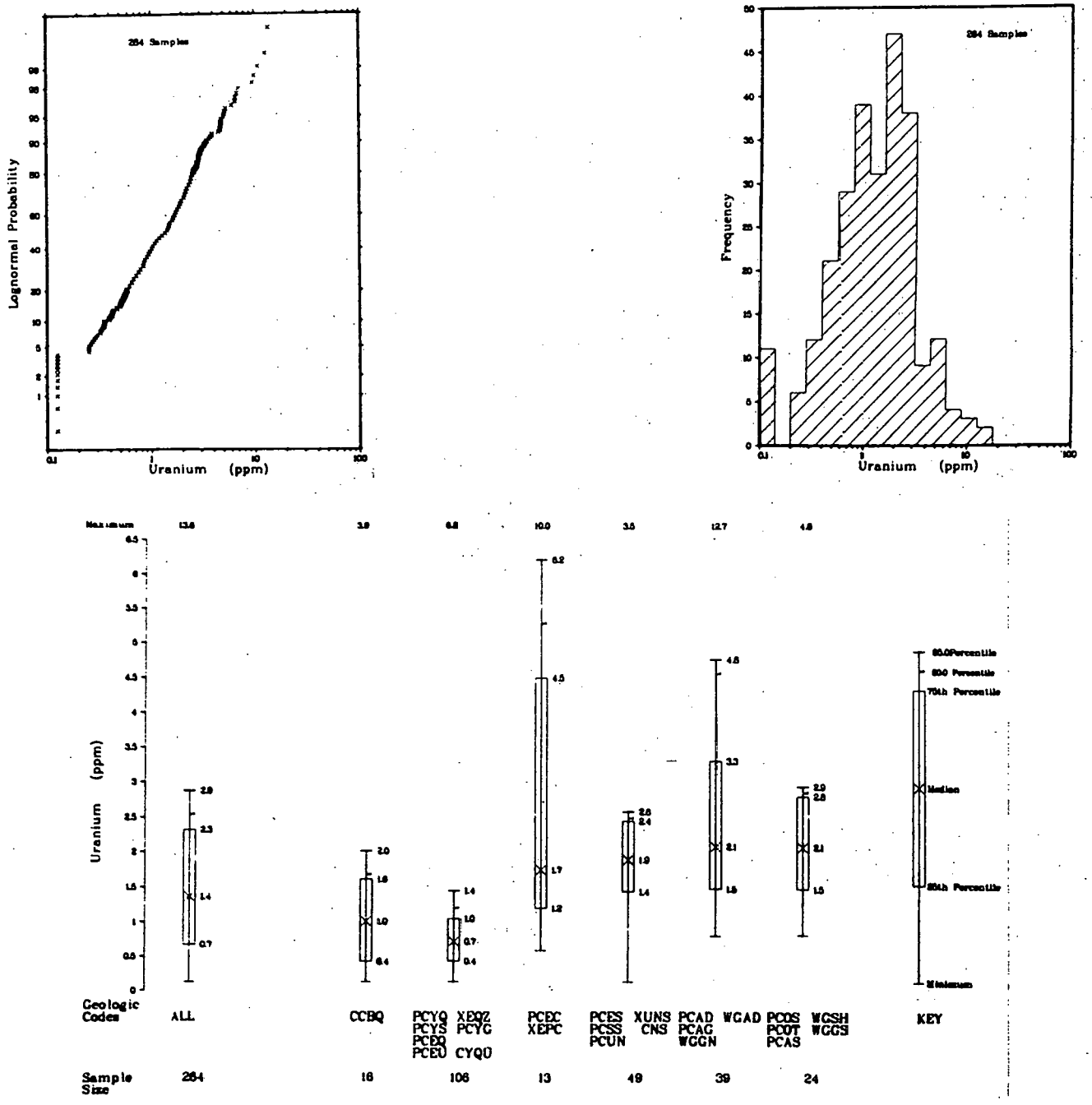


Figure C-2. Logprobability, logfrequency, and percentile plots of uranium (fluorimetric) in rock samples

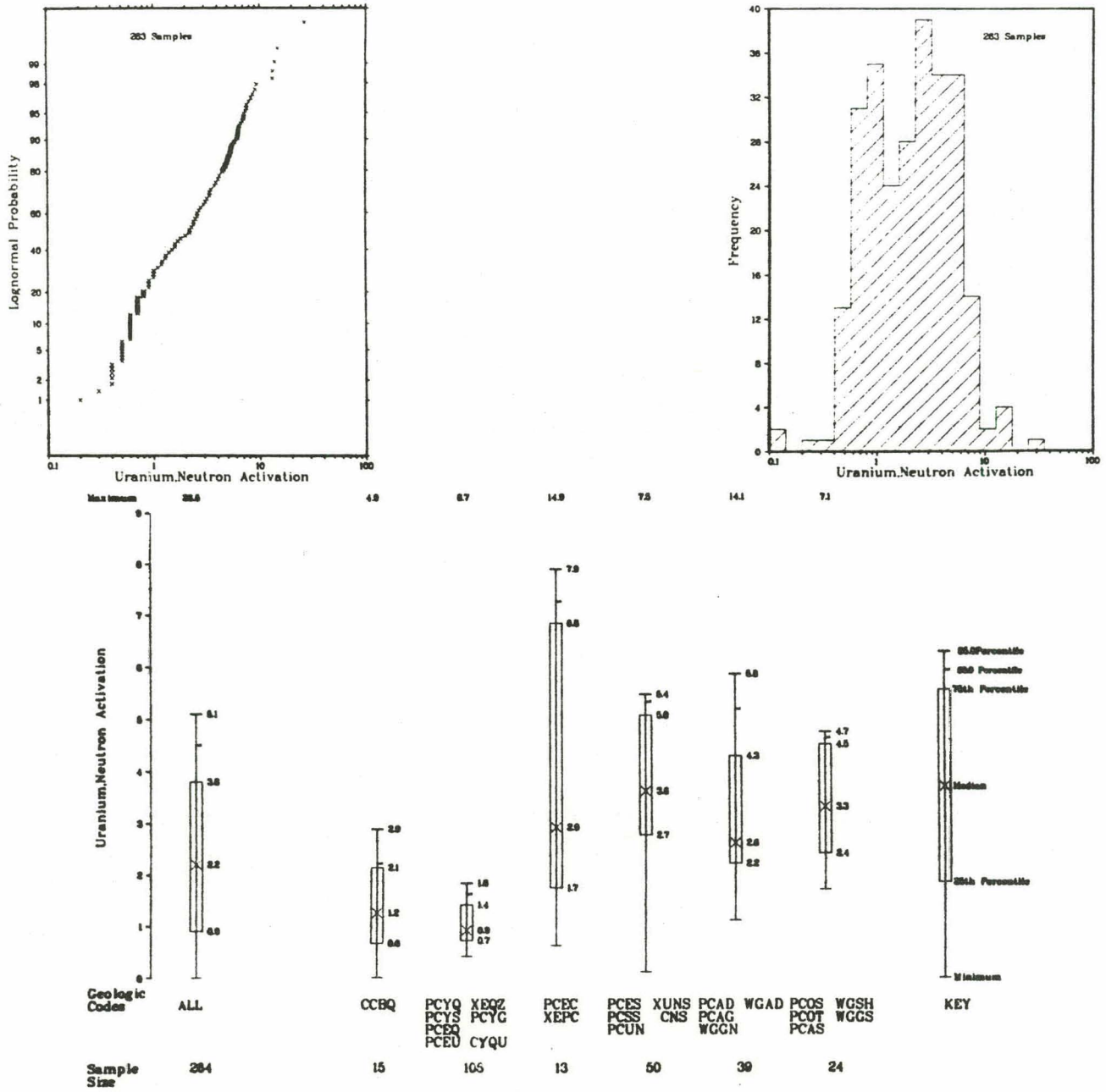


Figure C-3. Logprobability, logfrequency and percentile plots of uranium (neutron activation) in rock samples

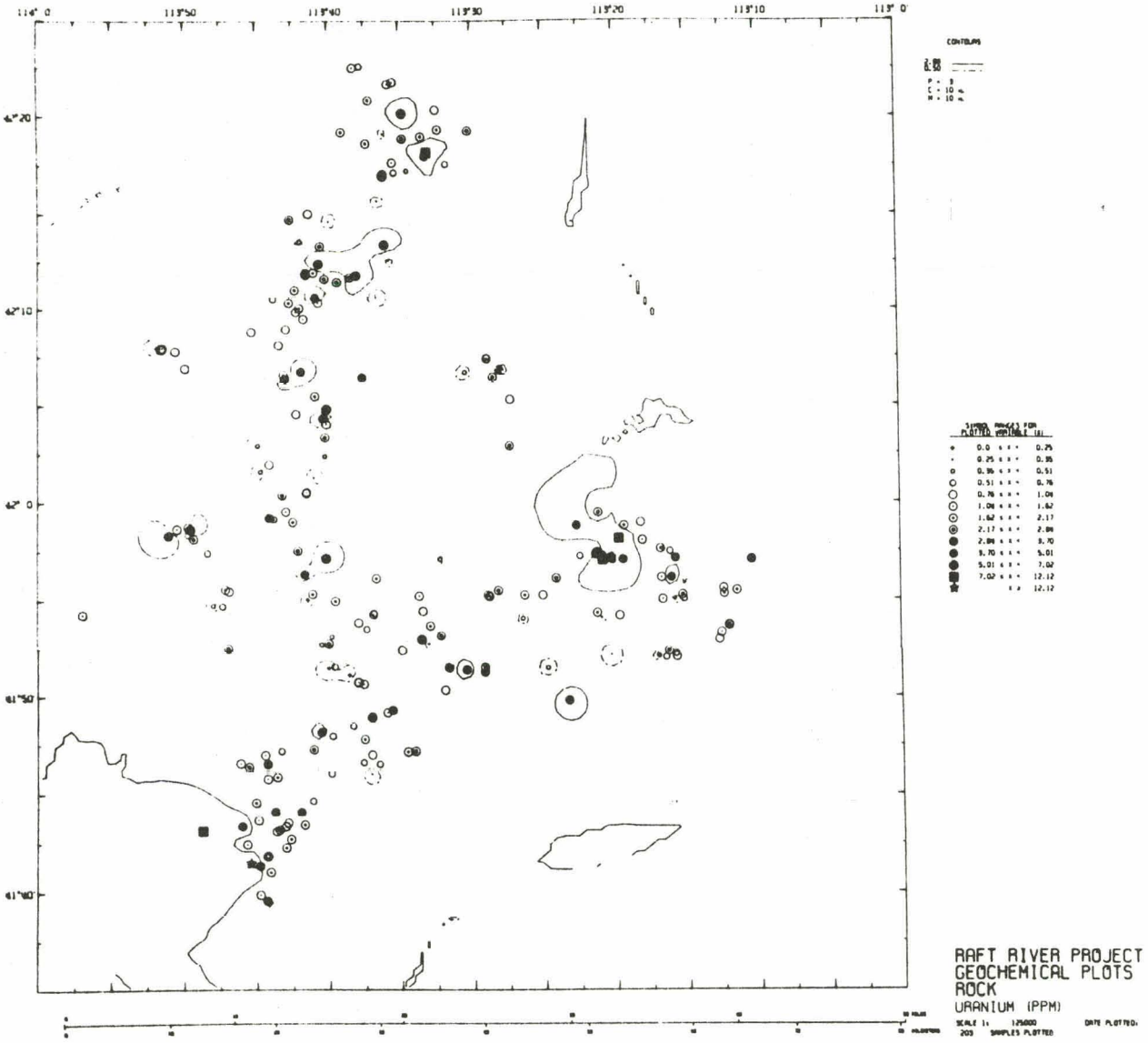


Figure C-4. Areal distribution of uranium(fluorimetric) concentrations in rock samples

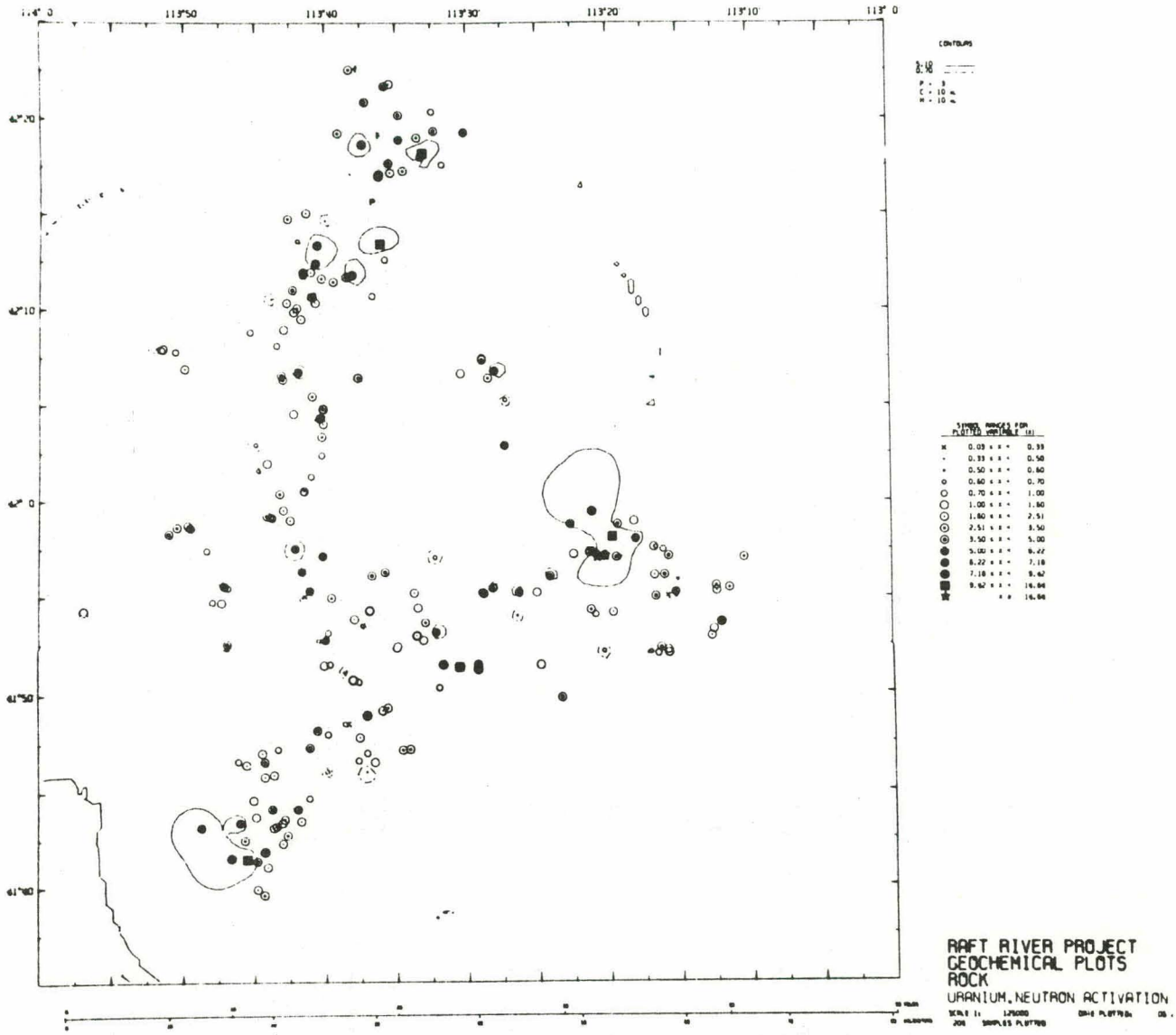


Figure C-5. Areal distribution of uranium,(neutron activation) concentrations in rock samples

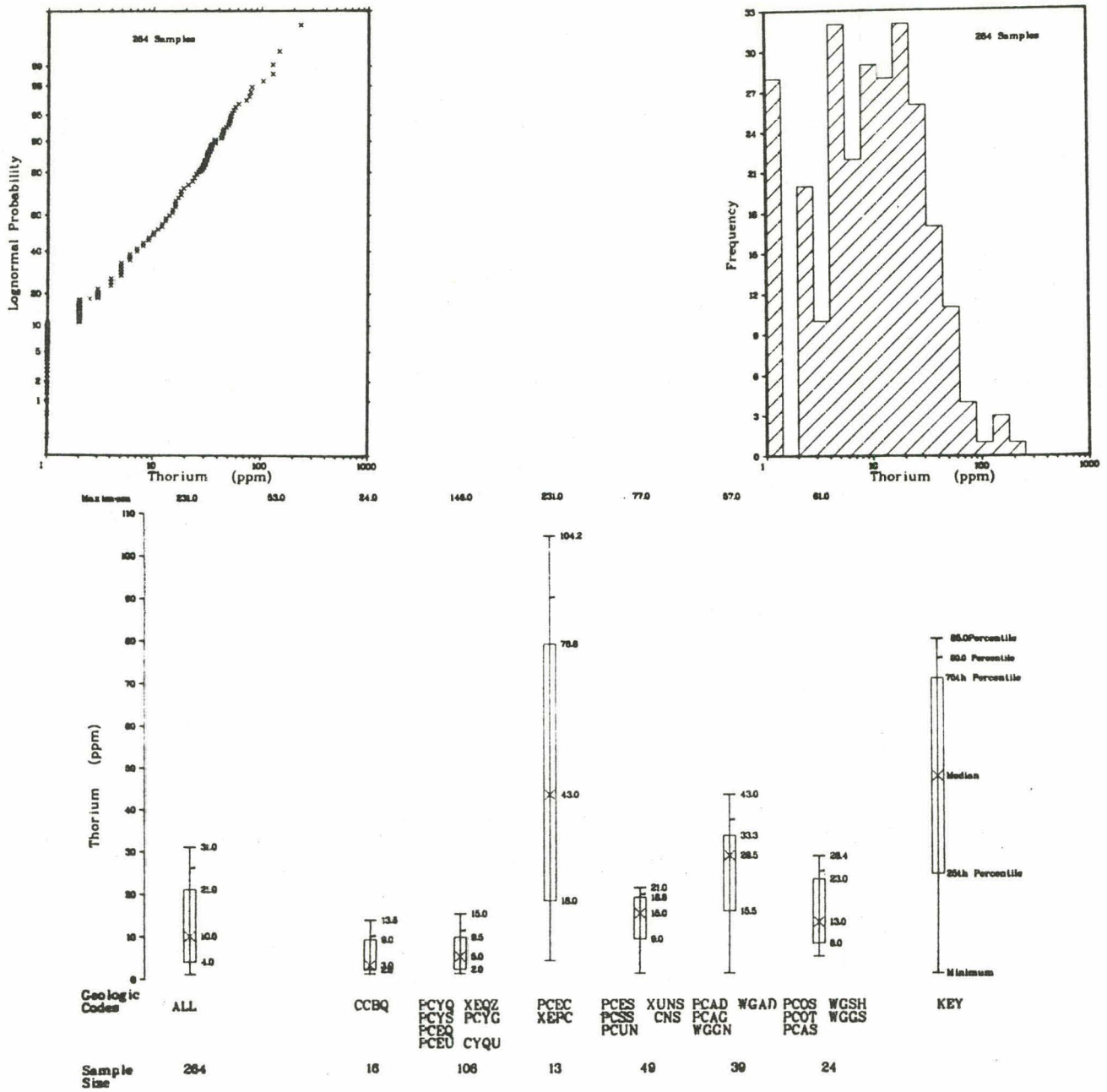


Figure C-6. Logprobability, logfrequency and percentile plots of thorium in rock samples

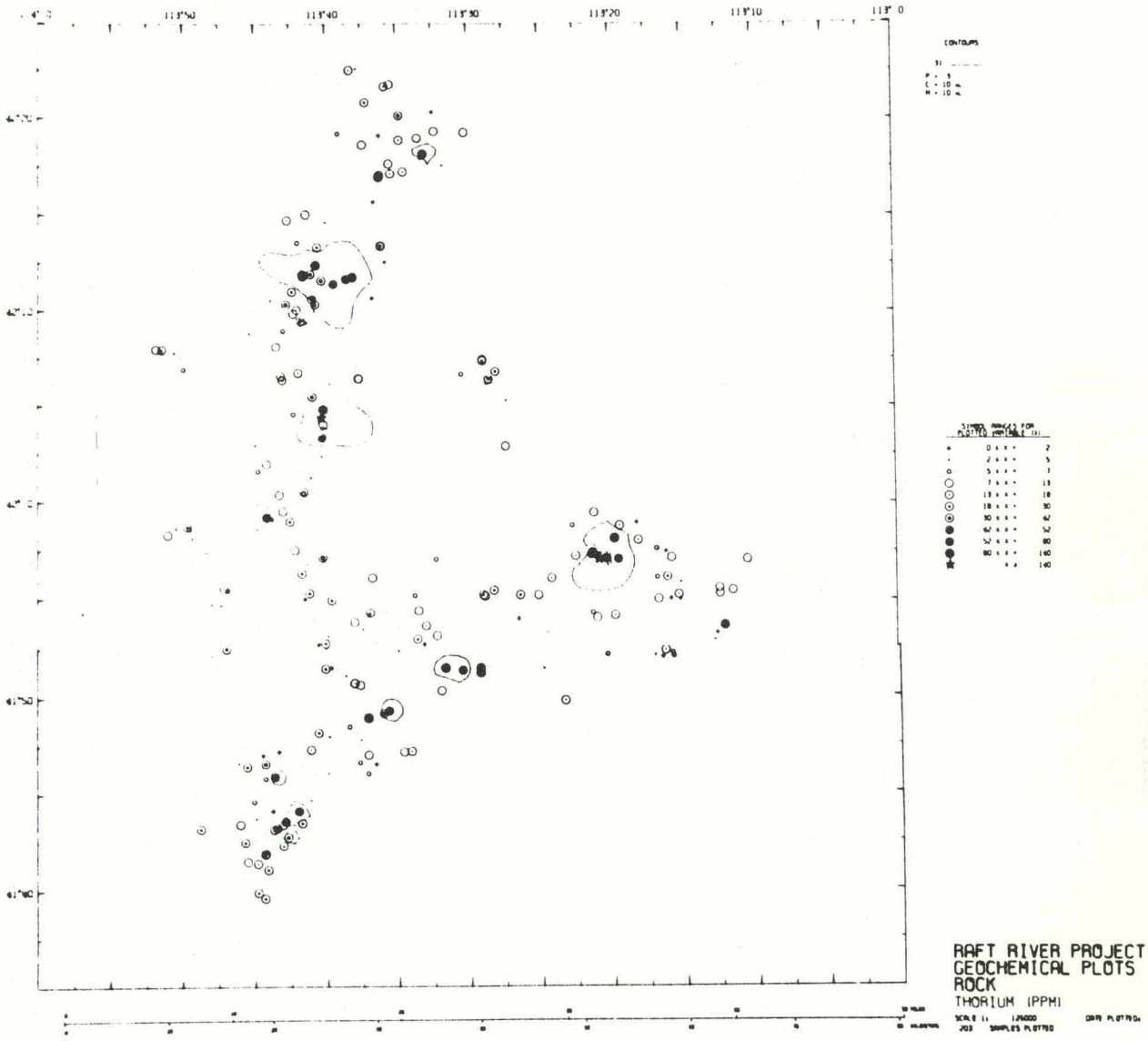


Figure C-7. Areal distribution of thorium concentrations in rock samples

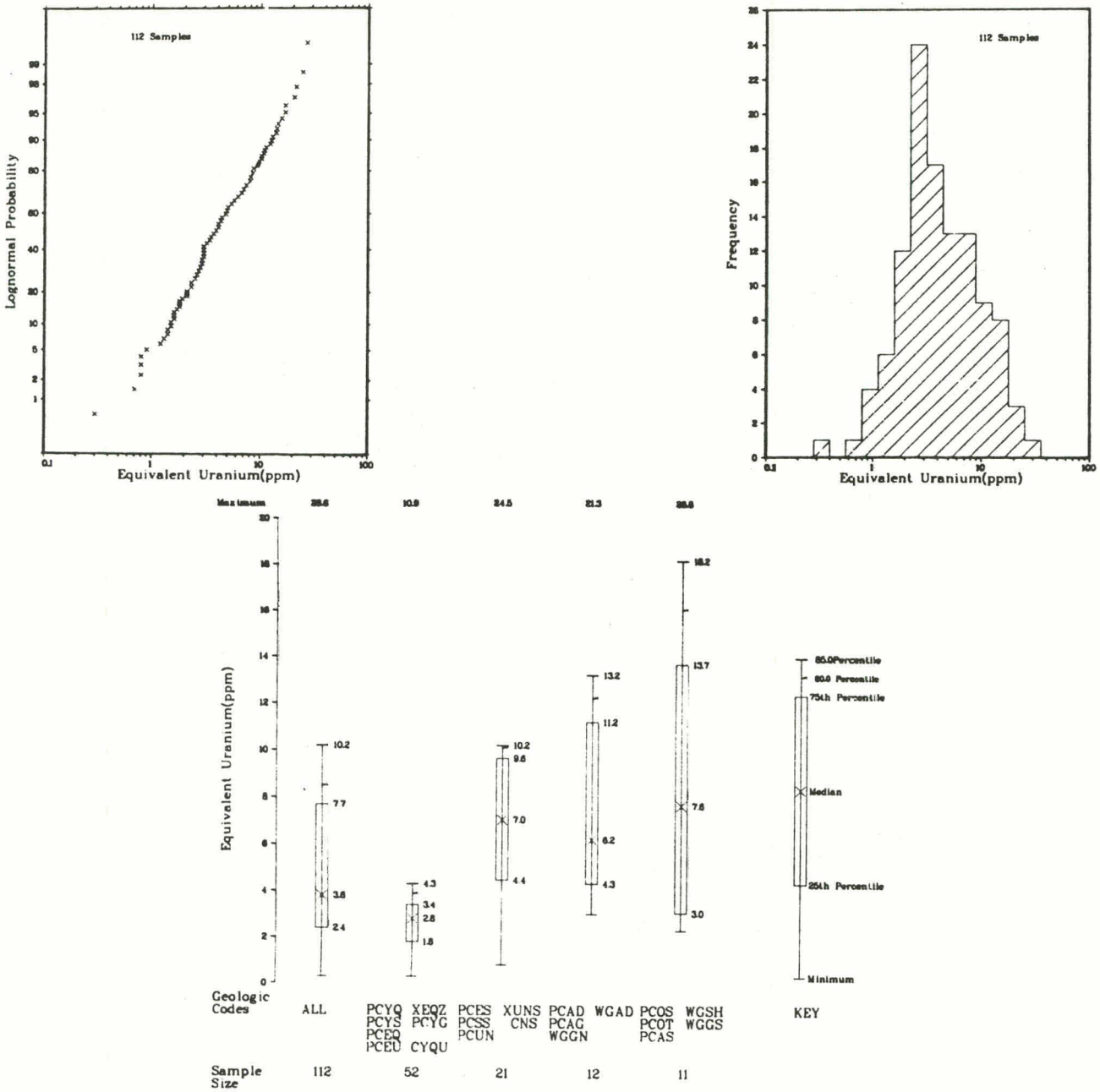


Figure C-8. Logprobability, logfrequency and percentile plots of radiometric equivalent uranium in rock samples

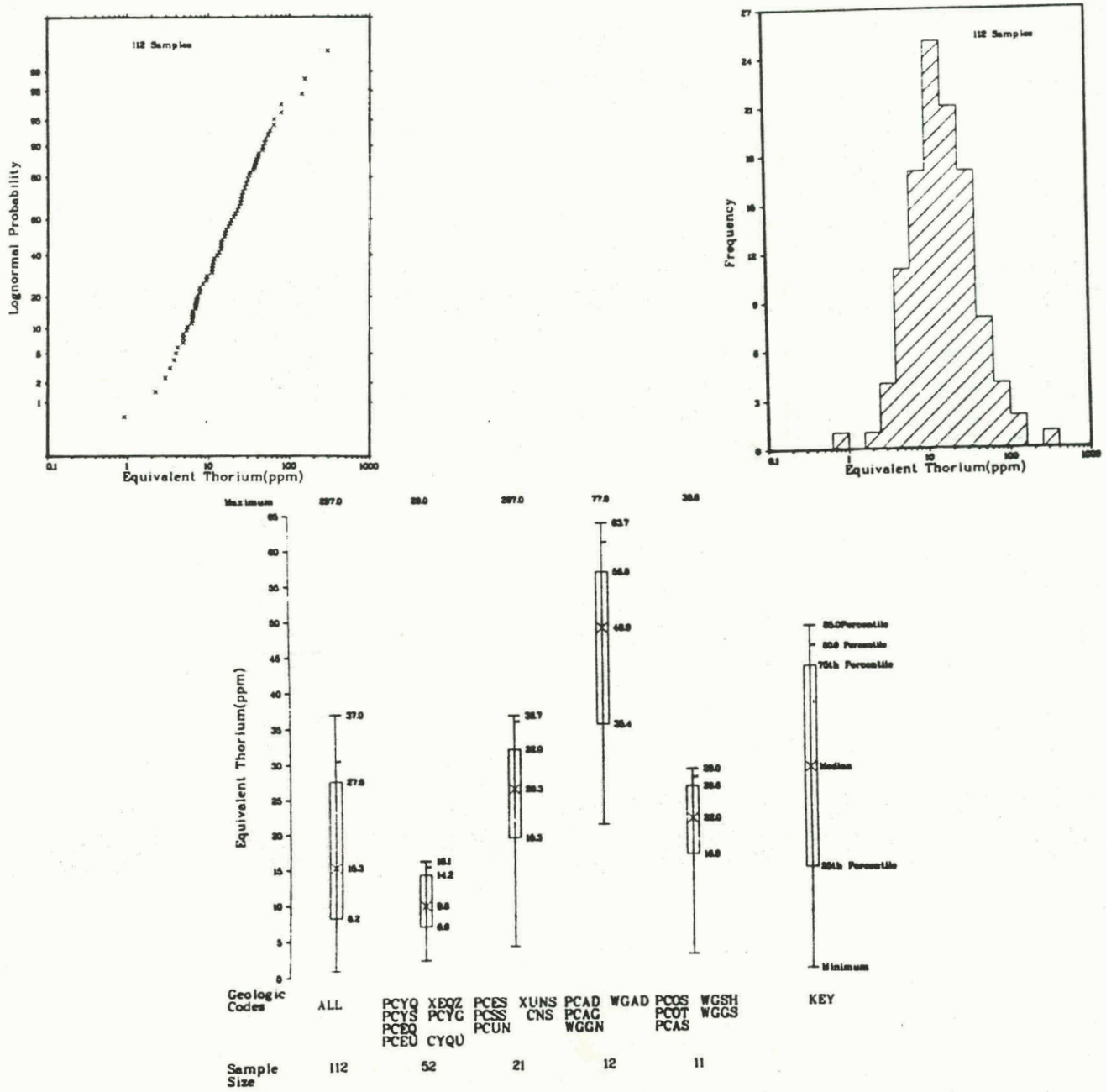


Figure C-9. Logprobability, logfrequency and percentile plots of radiometric equivalent thorium in rock samples

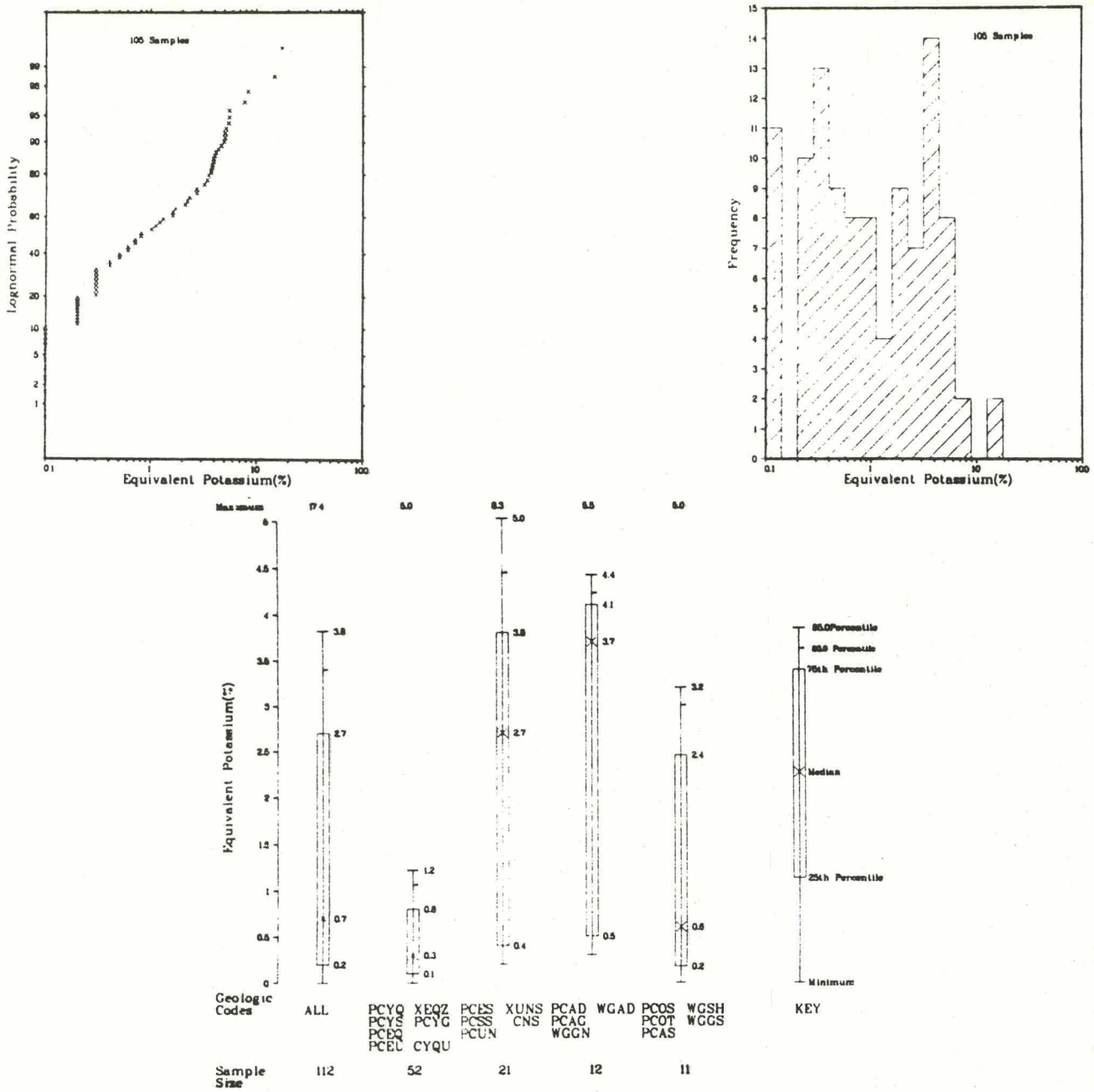


Figure C-10. Logprobability and logfrequency percentile plots of radiometric equivalent potassium in rock samples

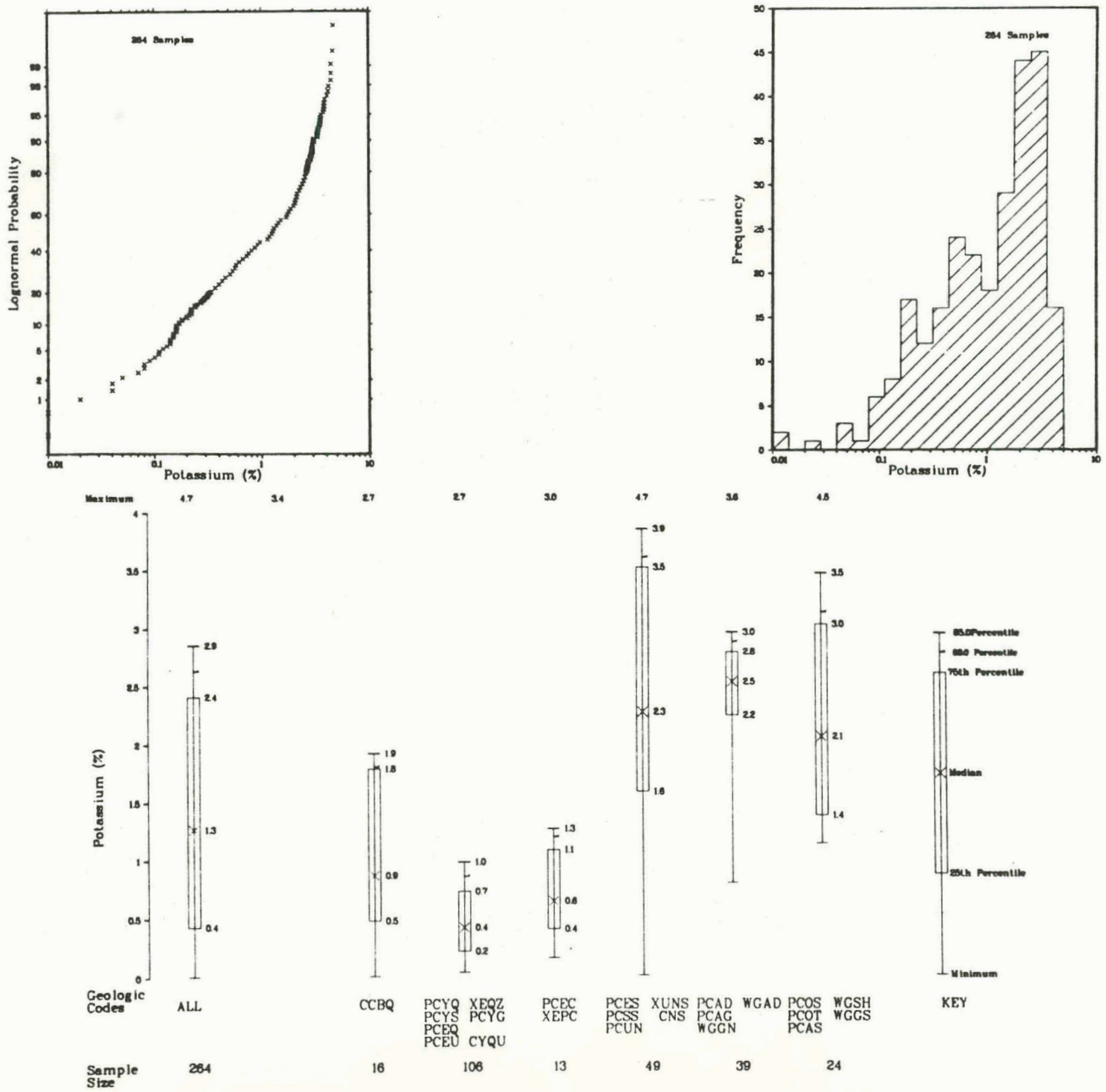


Figure C-11. Logprobability, logfrequency, and percentile plots of potassium in rock samples

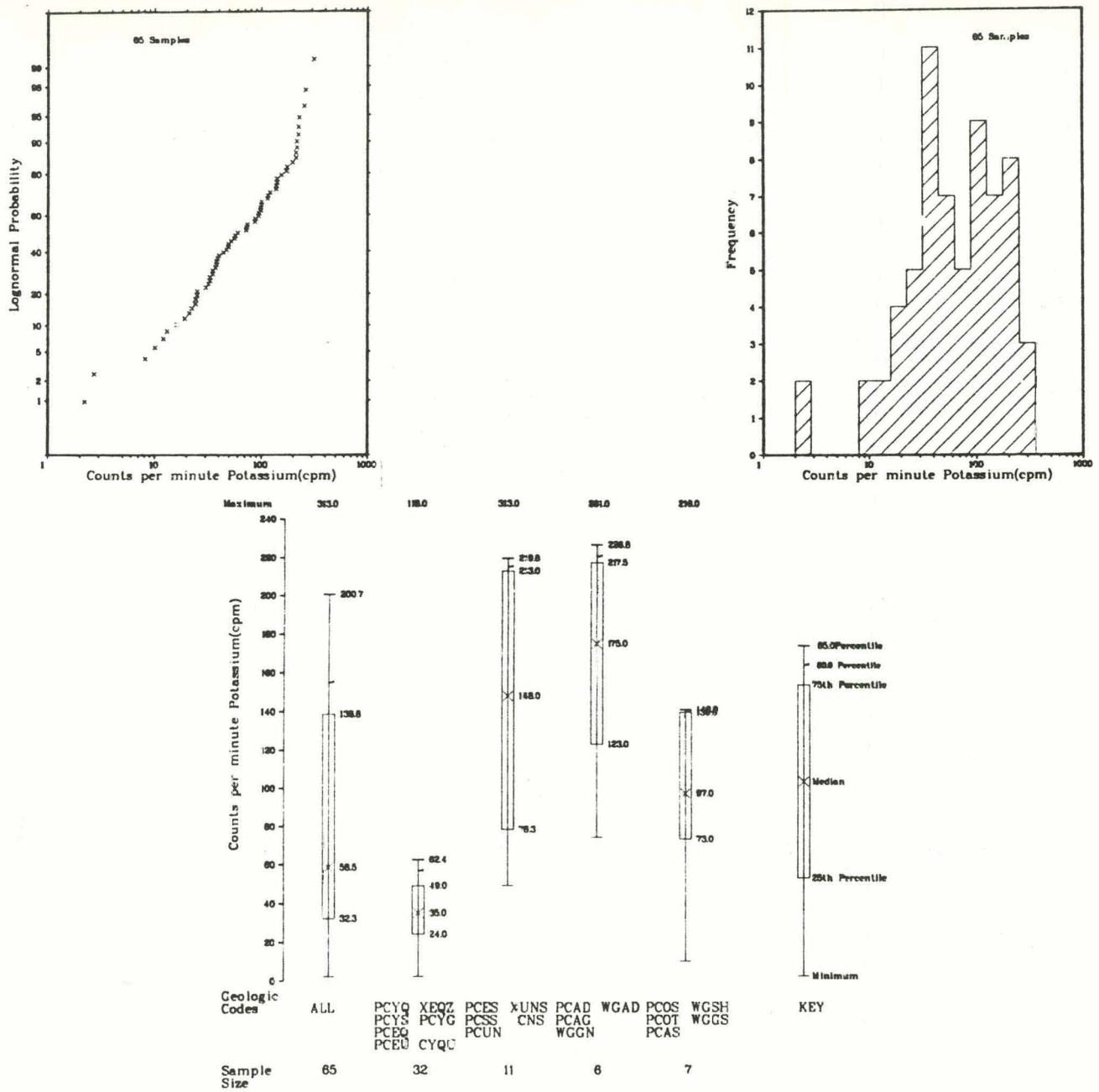


Figure C-12. Logprobability, logfrequency, and percentile plots of spectrometer radiation data for potassium in rock samples

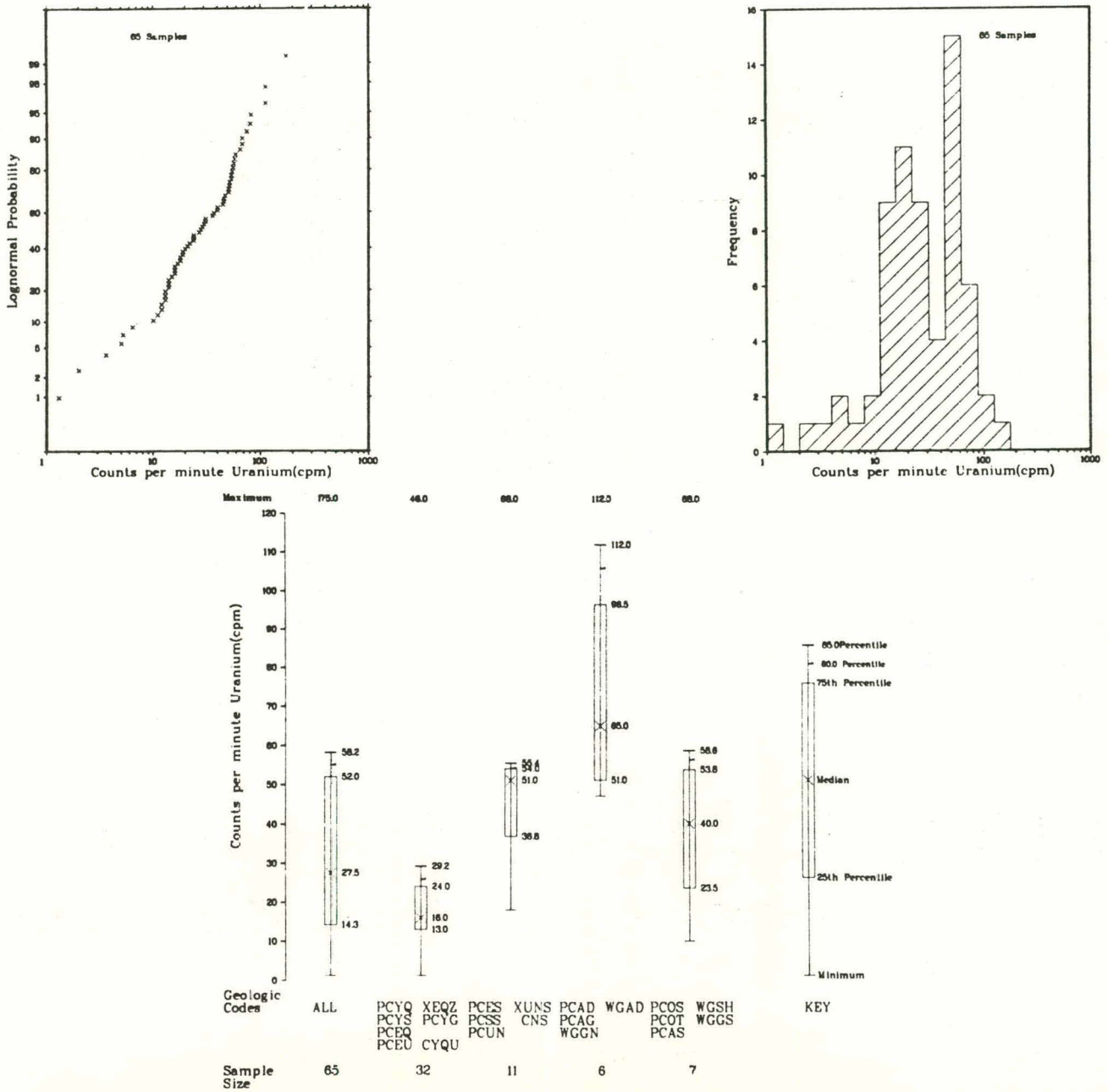


Figure C-13. Logprobability, logfrequency, and percentile plots of spectrometer radiation data for uranium in rock samples

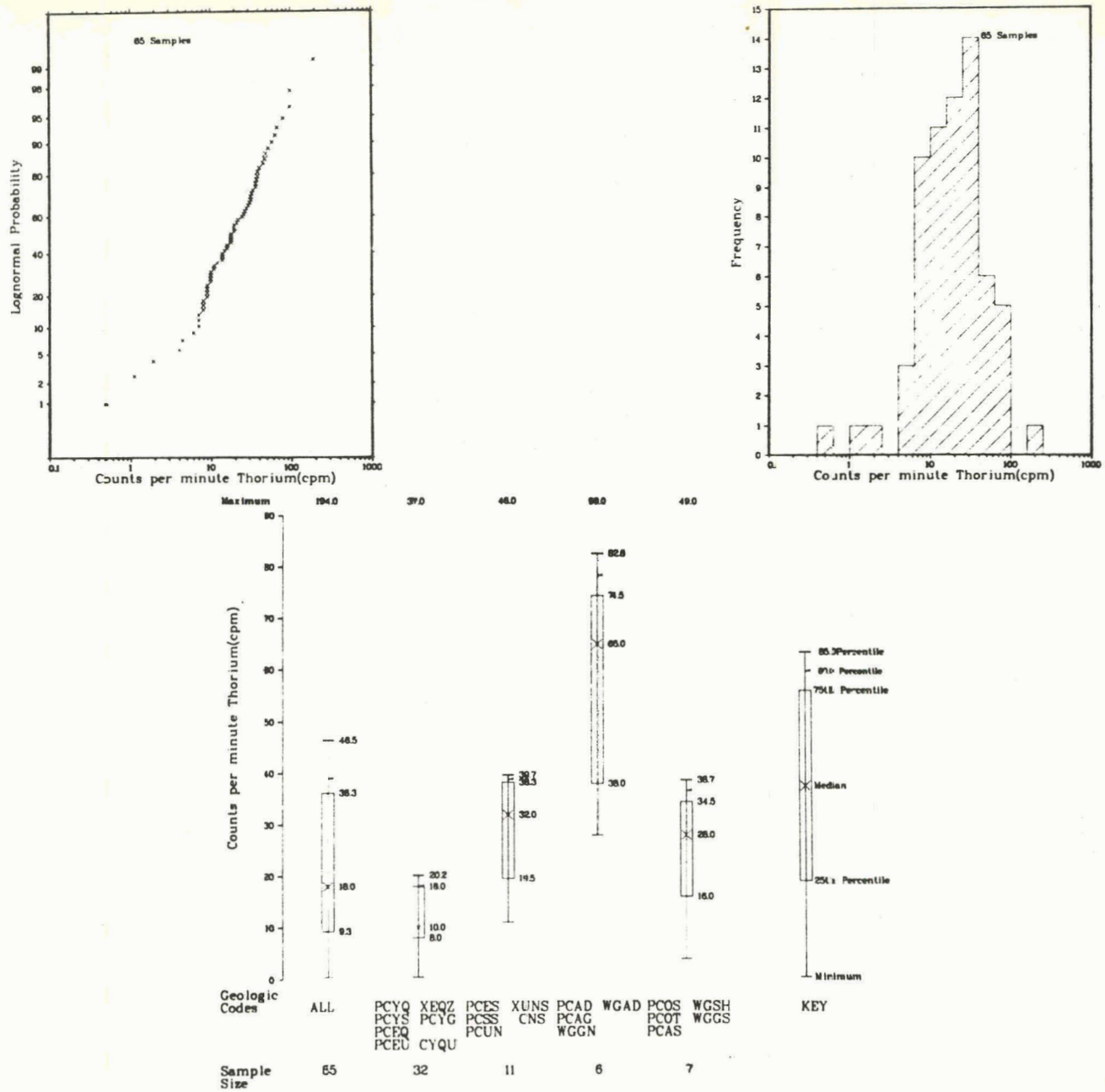


Figure C-14. Logprobability, logfrequency, and percentile plots of spectrometer radiation data for thorium in rock samples

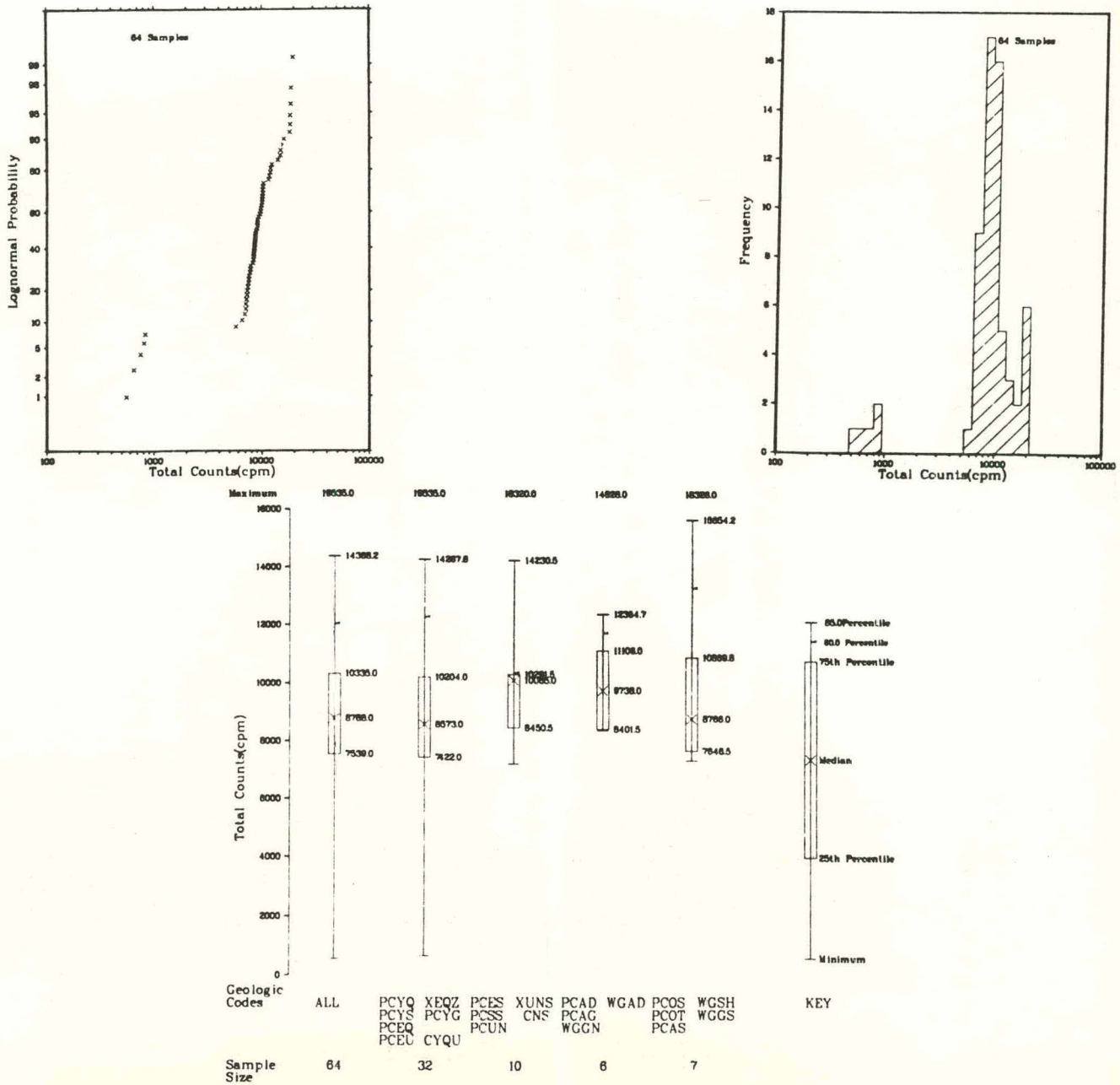


Figure C-15. Logprobability, logfrequency, and percentile plots of spectrometer radiation data to K.U.T. in rock samples

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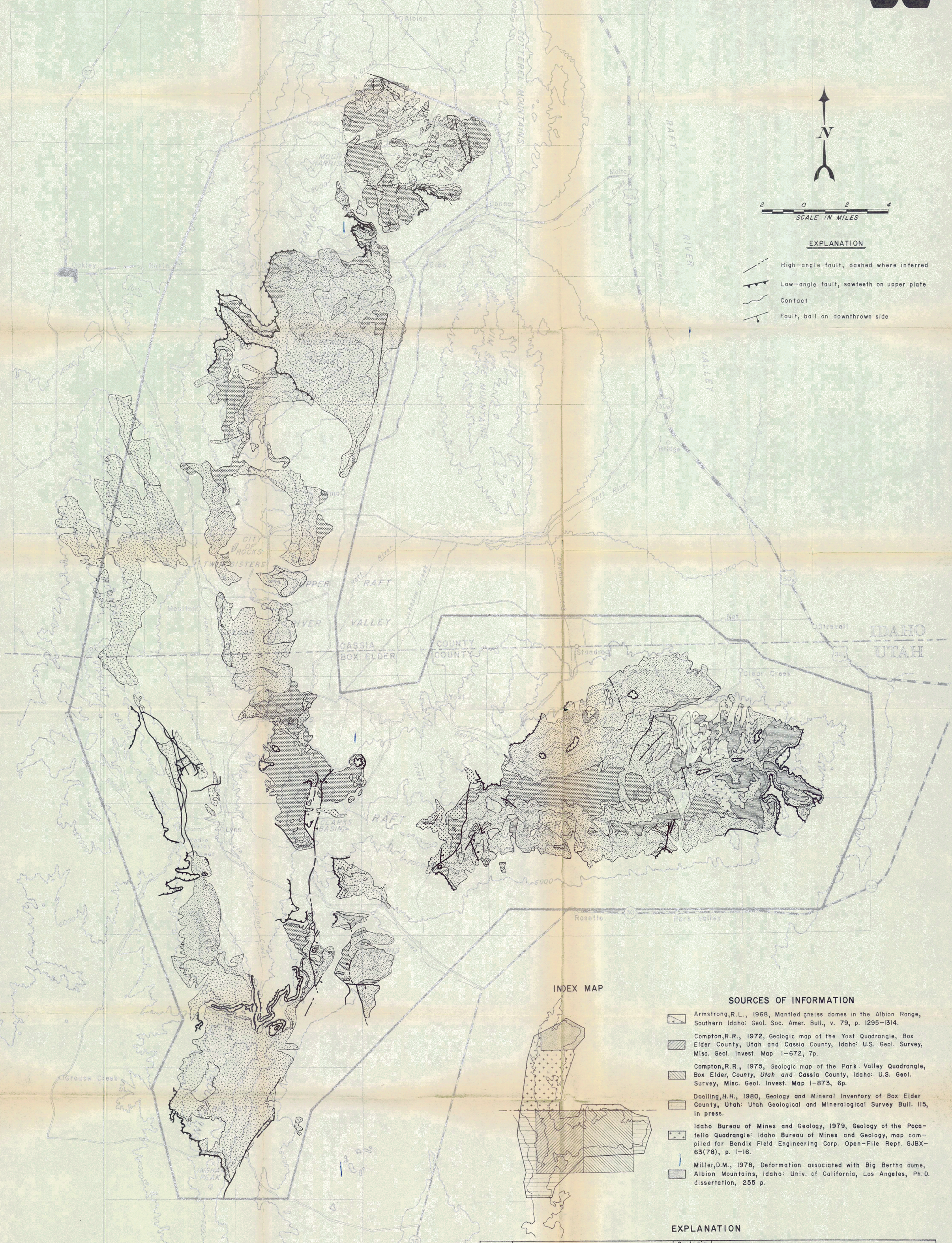

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EXPLANATION

Map Pattern	Formation	Geologic Unit Code	Author	
	Quartzite of Yost	€y	Idaho Bureau of Mines & Geology, 1979	
		Xy	Miller, 1978	
		P€y	Compton, 1972	
	Schist of Upper Narrows	€ns	Idaho Bureau of Mines & Geology, 1979	€O Armstrong
		Xun	Miller, 1978	
		P€un	Compton, 1972, 1975, Doelling, 1979	
		P€ug	Compton, 1975	
	Elba Quartzite	€?	Armstrong, 1968	
		Xe	Miller, 1978	
		P€e	Compton, 1972, 1975, Idaho Bureau of Mines & Geology, 1979, and Todd, 1973; and Doelling, 1979	
		P€es	Compton, 1975, Idaho Bureau of Mines & Geology, 1979, and Todd, 1973	
	Older Schist	P€os	Compton, 1972, 1975, and Doelling, 1979	
	Metamorphosed Trondhjemite and Pegmatite	P€t	Compton, 1975	
	Green Creek Complex (Idaho)	Wg & gn	Idaho Bureau of Mines & Geology, 1979	
		Wgc	Miller, 1978	
		P€	Armstrong, 1968	
	P€ Adamellite (Utah)	P€ad	Compton, 1975, and Todd, 1973	
		ad	Compton, 1972	
		P€a	Doelling, 1979	

PLATE 1 Geologic Map of Selected Precambrian Formations in the Raft River, Grouse Creek, and Albion Ranges, Utah and Idaho

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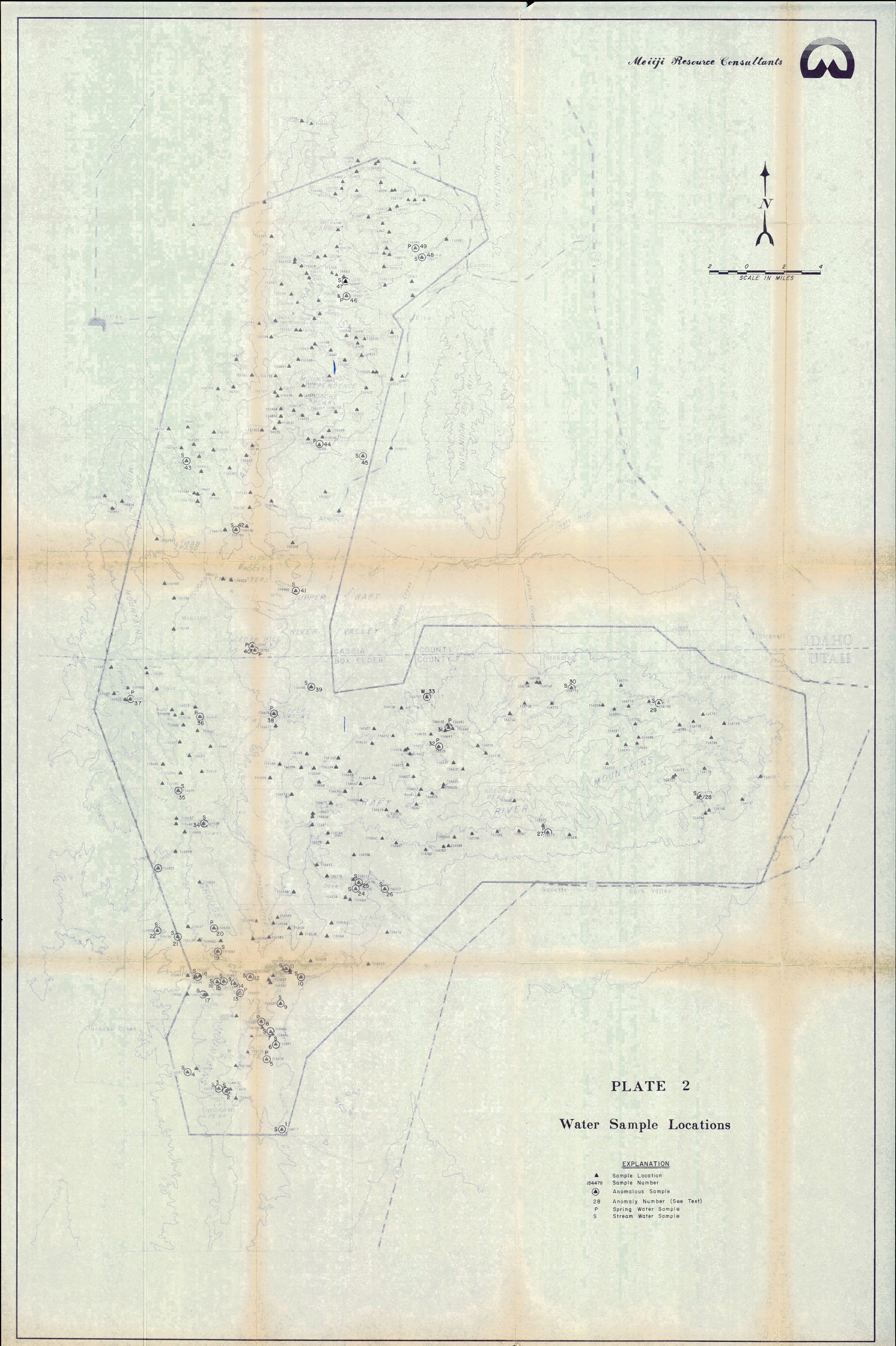

PLATE 2

Water Sample Locations

EXPLANATION

▲	Sample Location
154478	Sample Number
(▲)	Anomalous Sample
28	Anomaly Number (See Text)
P	Spring Water Sample
S	Stream Water Sample

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PLATE 3

Sediment Sample Locations

EXPLANATION

●	Sample Location
154575	Sample Number
▲	Anomalous Sample
47	Anomaly Number (See Text)

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PLATE 4

Rock Sample Locations with Air Radiometric Anomolies, Known Mining Districts, and Stratigraphic Section Locations

EXPLANATION

Water	Sediment	Rock	
		□	Location of Sample without Radiation Reading
▲	◑	◪	Location of Sample with Scintillometer Reading
▲	●	■	Location of Sample with Spectrometer Reading
			Location of Stratigraphic Section
		○	Anomalous Rock Sample
		24	Anomaly Number (See Text)
		154581	Rock Sample Number
		20	Air Radiometric Anomaly Location and Number (See Text)
		⬭	Approximate Boundary of Mining District
		ROSEBUD	Name of Mining District