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REPORT ON AIRBORNE RADIOACTIVITY SURVEYS AND THE URANIUM DEPOSITS IN THE RED RIVER REGION OF TEXAS AND OKLAHOMA

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REPORT ON AIRBORNE RADIOACTIVITY SURVEYS AND THE URANIUM DEPOSITS IN THE RED RIVER REGION OF TEXAS AND OKLAHOMA

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This report was compiled by R. A. Levich from manuscripts by R. G. Blair and F. T. Stehle, dated 1956 and 1957. Some material has been updated and expanded.

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ABSTRACT

The U.S. Atomic Energy Commission conducted an airborne radioactivity survey of the Red River region of Texas and Oklahoma beginning in December 1955 and ending in May 1956. All or parts of Archer, Clay, and Montague Counties in northern Texas and Carter, Cotton, Jefferson, and Stephens Counties in southern Oklahoma were surveyed. Particular attention was paid to those areas where exposures are found of red beds of the Permian Wichita Group.

Field examinations were conducted of anomalies dicovered by airborne reconnaissance as well as those reported by private individuals. Forty localities were examined, the majority in sandstones, siltstones, or conglomerates. Uranium and copper minerals were identified at several localities. Ferruginous staining, bleaching of the sandstone color, calcium carbonate cement, and carbonized plant remains are common to the deposits.

INTRODUCTION

Location, Accessibility and Topography

The region described in this report is located in the Osage Plains section of the Central Lowland province in northern Texas and southern Oklahoma, south of the Wichita Mountains. The Red River forms the boundary between the states of Oklahoma and Texas (Fig. 1).

Accessibility is very good. Paved or graveled roads lie within one mile of nearly all the examined localities. Most of the land is used for pasture or is cultivated; scattered clusters of mesquite are found in the southern part of the area. The climate is warm and semi-humid.

The land surface varies from a gently rolling plain in Oklahoma to locally hilly regions in Texas. North of the Red River, small exposures of indurated rocks are found in gullies and along the channels of intermittent streams. The best exposured sections are found on bluffs which rise 200 feet above the floodplain of the Red River. To the south, resistant rocks cap low escarpments and buttes. The ubiquitous soil cover conceals much of the bedrock. Elevations range between 750 and 1,200 feet above sea level.

Industrial water supplies are available from wells and reservoirs throughout the region.

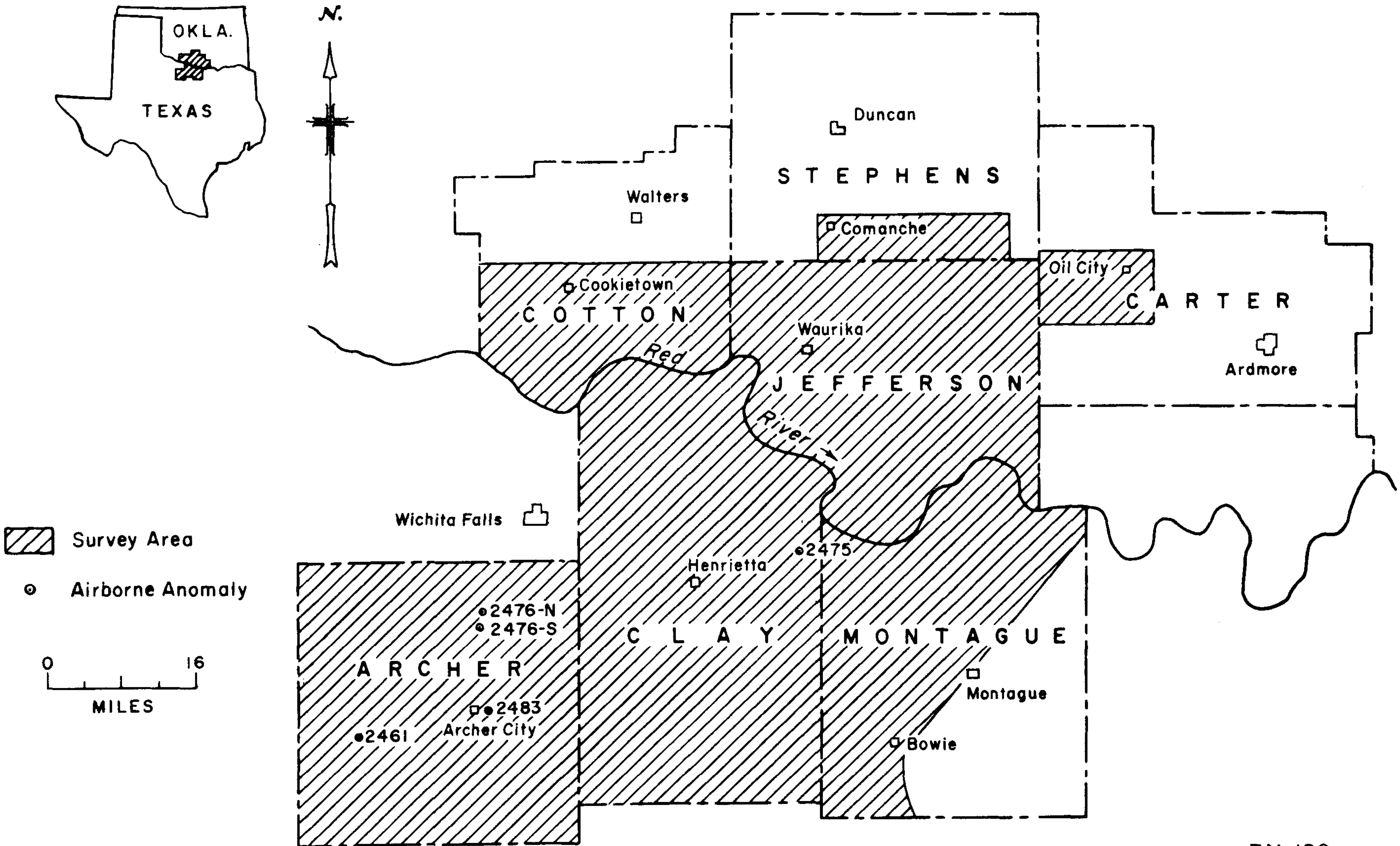

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Figure l. Index map of the area of airborne radiometric surveys in the vicinity of the Red River region, Texas — Oklahoma

History of Exploration and Land Ownership

The discovery of uranium minerals was first made public in 1954. There has been sporadic prospecting, but no economic deposits have been discovered.

All known occurrences of abnormal radioactivity are located on private property. Minor amounts of land are held by State, Federal and Indian agencies; none are known to be open to prospecting by the public.

Purpose, Methods and Scope of Investigation

Although no economic deposits of uranium have been found in the Permian rocks of northern Texas and southern Oklahoma, the large number of small sub-ore grade occurrences warranted investigation.

In May 1955, the Commission began an airborne radiometric reconnaissance of the region, using a Piper PA-18 aircraft equipped with a Mark VII scintillation counter. Due to relatively severe radioactive "fallout" from test explosions in Nevada, only approximately two hours of surveying were completed before the reconnaissance was temporarily postponed. Aerial reconnaissance was not resumed until the start of the project outlined in this report.

Three methods of investigation were used: 1) airborne radiometric surveying; 2) surface examination of all known anomalous radioactivity; and 3) stratigraphic studies by the U.S. Geological Survey. The first two methods are described in this report while stratigraphic data are included where applicable.

Most of the maps used were county road maps which show drainage and culture. These maps are published by the respective State Highway Departments for all counties at a scale of 1" - 2 miles; and were used as base maps by both the airborne and ground crews.

The Red River region is partially covered by standard topographic maps; 7½ minute, 15 minute, and other series are available for all or part of the following counties; Montague, Wichita and Archer in Texas; and Jefferson, Love, Carter, and Stephens in Oklahoma.

Geological maps of Texas (Darton and others, 1937) and Oklahoma (Miser, 1954) were used extensively. Aerial photographs are available for the entire area at scales of approximately 1:20,000 and 1:70,000.

The airborne survey began on December 15, 1955, and terminated on May 29, 1956. The aircraft used was a Piper PA-18, fitted with a Nuclear Enterprise Mark VI scintillometer. Later in the project, a Welltab recorder (Welltab, Inc., Santa Fe, N.M.) was mounted in the aircraft to make a continuous record. The flight altitude maintained was approximately 100 feet above the ground surface.

The airborne survey covered parts of the following counties: Archer, Clay, and Montague in Texas; and Jefferson, Stephens, Cotton, and Carter in Oklahoma (Fig. 2). Areas where rocks in the lower part of the Permian Wichita Group are exposed were given particular attention.

In Oklahoma, section-line roads are abundant and parallel flight lines were maintained one mile apart. In Texas, this spacing varied from one half to two miles due to the irregularity of check points. In unrecorded areas, the spacing averaged one-half mile.

Anomalies discovered by airborne reconnaissance and those reported by private individuals were examined on the ground. Field examinations were made in Wichita, Wilbarger, Archer, Clay, and Montague Counties in Texas; and in Cotton, Tillman, Jefferson, Stephens and Carter Counties in Oklahoma.

ACKNOWLEDGMENTS

The authors wish to acknowledge the contributions of several U.S. Atomic Energy Commission geologists, as well as the aid of oil company geologists and numerous local residents who provided both geologic data and access to properties. Special thanks are given to D. Hoye Eargle of the U.S. Geological Survey for stratigraphic data used in this report, as well as for his help in locating several deposits.

GENERAL GEOLOGY

Stratigraphy

Pennsylvanian, Permian, and Lower Cretaceous rocks crop out in the Red River region. Extensive Quaternary sand and gravel deposits are located in Wilbarger and Baylor Counties, Texas, and along the Red River (Plate 1). The uranium deposits are found exclusively in Permian sedimentary rocks (Tables 1, 2, and 3). The rock unit names and definitions which appear in this report were those in general use in the mid-1950's when the original manuscripts were written.

Pennsylvanian Rocks

Rocks of the Upper Pennsylvanian Cisco Group crop out in southern Montague and Clay Counties, Texas, and consist principally of shales with minor amounts of sandstone.

The contact between Pennsylvanian rocks and the overlying Permian sediments is conformable and gradational; it is difficult to trace both at the surface and in the subsurface.

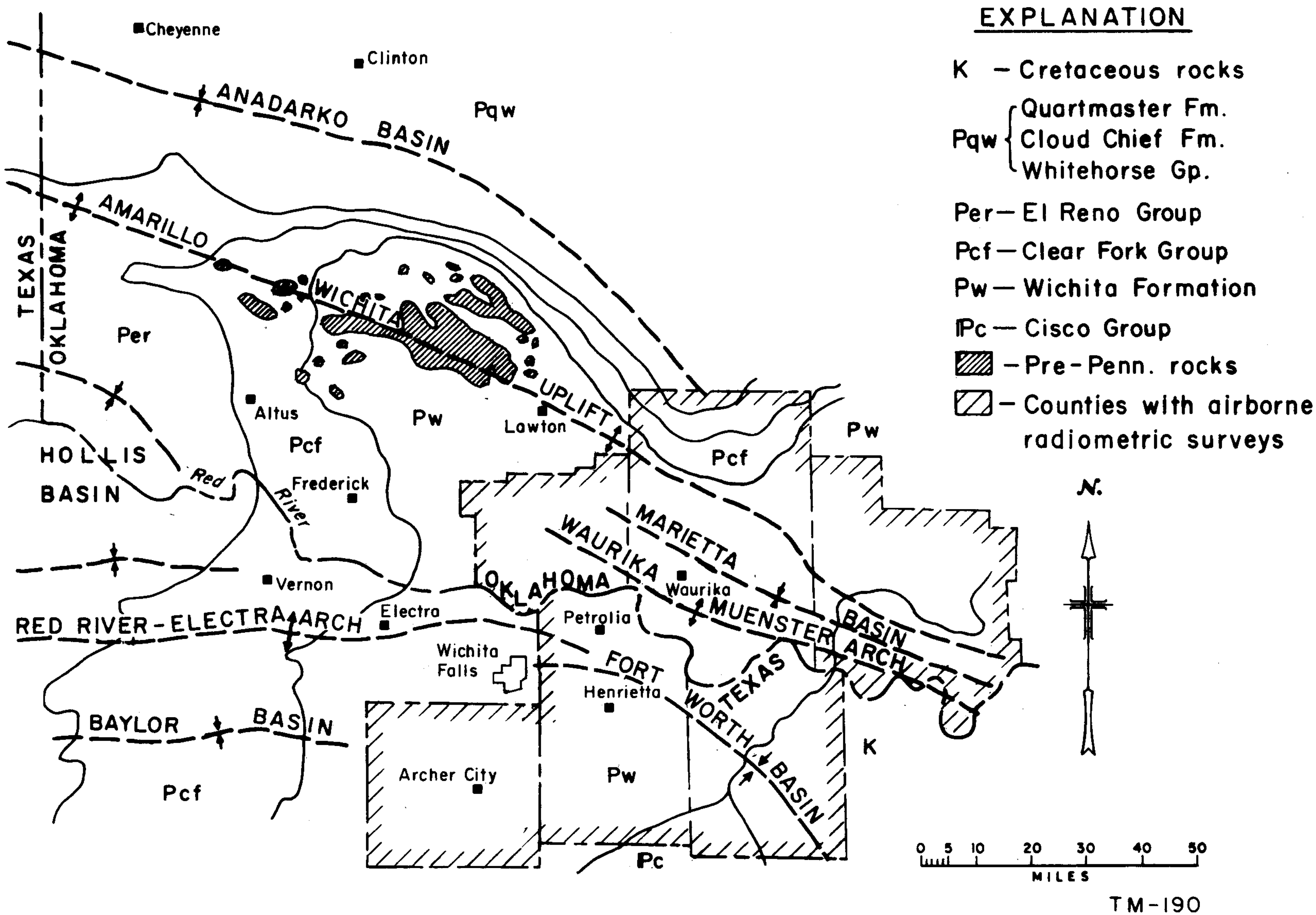

Figure 2. Generalized geologic and tectonic map of the Red River region indicating the counties of Texas and Oklahoma covered by airborne radiometric surveys.

SYSTEM	NORTHERN TEXAS			SOUTHERN OKLAHOMA		
	GROUP	FORMATION	MEMBER	GROUP	FORMATION	MEMBER
LOWER CRETACEOUS	Fredricks-burg Group			Fredricks-burg Group		
	Trinity Group			Trinity Group		
	unconformity	unconformity				
PERMIAN	El Reno Group	Blaine Gypsum		El Reno Group	Blaine Gypsum	
					Flower Pot Shale	
		San Angelo Sandstone			Duncan Sandstone	
		unconformity	unconformity			
	Clear Fork Group			Clear Fork Group	Hennessey Shale	
					Garber Sandstone	
	Wichita Group	Lueders Limestone			Wichita Formation	
		Clyde Formation				
		Belle Plains Formation	Beaverburk Ls.			
		Admiral Formation	Coleman Jct horizon			"t" bed or Ryan Sandstone
		Putnum Formation	Coleman Jct Ls.			
		Moran Formation				Post Oak Conglomerate
		Pueblo Formation				
PENNSYLVANIAN	Cisco Group	undifferentiated			Vanoss Formation	

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Table 1. Generalized geologic column of northern Texas and southern Oklahoma (in general use during 1956 and 1957).

Permian Rocks

Permian sedimentary rocks are exposed over the greater part of the Red River region. The 4,000 to 5,000 feet of Permian section consist entirely of red bed facies: red and gray shales and sandstones. The principal rock-type is reddish-brown shale; thin limestone beds and pebble conglomerates are also present. On the south flank of the Wichita Mountains, at the northern edge of the region, arkosic, granite wash conglomerates form wedges which intertongue with the red beds.

Wichita Group (Formation) - In the Red River region all of the radioactive localities, with four exceptions, are found in the Permian Wichita rocks.

In north-central Texas the Wichita Group consists of seven formations (Table 1); however, in the Red River region, there are only three mappable units. Limstones, present in north-central Texas, grade northward into red bed facies.

The lowermost of the mapped units is the Coleman Junction Limestone Member of the Putnam Formation. Limestones of the member grade into red beds in southwestern Archer County, Texas. Nickell (1932) extended a Coleman Junction horizon across Archer and Clay Counties, Texas, to the banks of the Red River. It is mapped as the base of a series of persistent, lenticular sandstones which are considered to be more continuous than other sandstones within this part of the Wichita Group. This zone of sandstones is believed by some geologists to be equivalent to the t bed of Miser (1954) in the Wichita Formation of southern Oklahoma. Other geologists (Sellards and others, 1933) consider the Coleman Junction horizon to be stratigraphically lower than the base of the t bed.

The t bed, locally called the Ryan Sandstone, consists of lenticular, arkosic, channel sandstones, strongly crossbedded and containing carbonaceous material. Some of the channel sands are 10 to 15 feet thick and a few hundred feet wide. According to Miser (1954), the t bed is probably equivalent to the base of the Garber Sandstone in south-central Oklahoma. Hence, early investigations of certain uranium occurrences in the Red River region of Oklahoma (U.S. Atomic Energy Commission, 1968) listed the host rocks as Garber. Below the Coleman Junction horizon or t bed, the Wichita contain more arkose and sandstone units than elsewhere in the Red River section. The Post Oak Conglomerate Member in Oklahoma represents this coarse facies.

At a higher stratigraphic level in the Wichita rocks in Texas is the Beaverburk Limestone Member of the Belle Plains Formation. It is a dense ferruginous dolomitic unit, less than ten feet thick. This unit was mapped across Baylor County and into Wichita County (Eargle and McKay, 1956), where it pinches out near Iowa Park, Texas.

The uppermost mappable unit in the Wichita Group of the Red River region of Texas is the Lueders Limestone. This limestone grades northward into the red bed facies, and cannot be traced north of the Red River. In Oklahoma its stratigraphic position is probably represented by the contact between the Clear Fork Group and the Wichita Formation (Eargle and McKay, 1956).

More recent workers feel that the Permian rocks are far more complex than the above descriptions lead one to believe, and that a simplistic "layer-cake" approach is essentially meaningless when applied to most continental stratigraphy. Robert Kier of the Bureau of Economic Geology of the University of Texas at Austin (oral communication, 1973) found that many marker sand or limestone horizons are actually unconnected lithofacies, which were mapped as continuous because of apparent lithologic or stratigraphic distinction within the otherwise uniform red beds. Kier believes there was a tendency for early workers to connect units with similar lithology across dissected topography, and thus to form "marker horizons" of unrelated and discontinuous stringers.

There is a strong disagreement between vertebrate and invertebrate paleontologists concerning the definition of the Permian-Pennsylvania boundary. There is a stratigraphic disparity of up to several thousand feet, and the surface distance between the two proposed boundaries is approximately 20 miles. Granite wash deposits, including the Post Oak Conglomerate Member of the Wichita Formation, are arkoses and arkosic conglomerates derived from sediments eroded from the late Paleozoic Wichita Mountains. These sediments were deposited in wedge-shaped fans and channels during Pennsylvanian and early Permian time. The northern part of the region, south of the Wichita Mountains, is underlain by some of these deposits which interfinger with the shales and sandstones of the red bed sequence.

The Wichita Group is conformable with the overlying Clear Fork Group and the underlying Cisco Group. No pronounced unconformities have been found within the Wichita Group.

<u>Clear Fork Group</u>--The Clear Fork Group contains anomalous radioactivity in two localities. The Clear Fork Group is 1,200 to 1,500 feet thick and is similar in lithology to the Wichita Group; red shales predominate. The two radioactive localities are near the top of the unit. No unconformities are known within the group; however, an erosional unconformity separates it from the overlying San Angelo Sandstone. The Clear Fork Group has been correlated with the Hennessey Shale and Garber Sandstone of Oklahoma.

<u>El Reno Group</u>--In the Red River region, the El Reno Group is composed of the San Angelo Sandstone and the overlying Blaine Gypsum. The San Angelo Sandstone consists principally of gray crossbedded sandstone, and the Blaine Gypsum is chiefly composed of red shales which contain beds and veinlets of gypsum. The San Angelo and Blaine are the lowermost units of the El Reno

Group. In the Red River region neither are known to contain uranium, however the San Angelo Sandstone is commonly the host for copper minerals, in Texas, and near Creta, Oklahoma, the Flowerpot Shale is mined for copper.

Lower Cretaceous Rocks

Rocks of the Commanche Series overlap Permian and Pennsylvanian strata in eastern Montague County, Texas. The lowermost unit of this series, the Trinity Group, consists of light-colored sandstones. It is conformably overlain by limestones and marls equivalent in age to the Fredericksburg Group of central Texas. Uranium has not been reported in the Cretaceous rocks of the Red River region.

Structure

The strata of the Red River region dip at a low angle, generally less than one degree, to the west-northwest. Low southeast or east-facing escarpments are formed by the more indurated rocks.

The regional dip is modified by gentle basins and arches which are more pronounced below the surface: the Red River-Electra Arch trends east-west through Wilbarger and Wichita Counties; the northernmost expression of the Bend Arch is found in Archer County; and the eastern edge of the Baylor Basin is located in Baylor County. No relation is known between these broad flexures and location of uranium deposits (Plate 1).

To the north of the Red River region lies the Amarillo-Wichita Mountains, formed primarily of uplifted Cambrian intrusive, volcanic, and sedimentary rocks. These rocks are exposed for 60 miles along a N. 75 degree W. trend and continue to the subsurface to west of Amarillo in the Texas panhandle. Southwest of the mountains is the Hollis Basin which terminates to the south against the flank of the Red River Arch (Fig. 2).

No major faults are known at the surface. Several minor fracture zones are discussed below in the section concerning uranium deposits.

URANIUM DEPOSITS

Distribution

Uranium deposits are defined for the purpose of this report as bodies of rock that contain 0.10 percent or greater U_3O_8. In the Red River region, known deposits vary in size from a few pounds to several tons; they are numerous but generally small, lenticular in shape, and commonly parallel to the tops of the enclosing Permian beds. Nearly all deposits lie between the Beaverburk Limestone and the base of the Wichita rocks, a stratigraphic range of approximately 1,500 feet. Twenty-seven localities were examined in Texas (Table 2) and 13 in Oklahoma (Table 3); 30 are in

TABLE 2

OCCURRENCES OF RADIOACTIVE DEPOSITS IN THE RED RIVER REGION OF TEXAS
(Arranged stratigraphically in descending order)

AEC File No.	County	Property Name	Sample Data: Serial No.	Field No.	Type	eU_3O_8%	cU_3O_8%	Radioactivity: Background (MR/hr)	Maximum (MR/hr)	Lithologic Description	Stratigraphic Position	Remarks
2419	Wilbarger	Unknown	None	Taken				0.02	0.06	Carnotite(?) in small bituminous concretions within green shale in a thick red shale section.	In Clear Fork Group, about 50 ft. below San Angelo Sandstone.	
2417	Wilbarger	Russell & Murrell	229866	F-39254	Select	0.079	0.142	0.02	0.08	Same as above except carnotite(?) also occurs in fractures.	In Clear Fork Group	
2418	Wichita	Ancell	229863 229864 229865	F-39251 F-39252 F-39253	Channel Channel Channel	0.005 0.018 0.013	- - -	0.022	0.45	Carbonaceous sandstone, fractured, within calcareous sandstone; in interbedded sequence sandstone and shale; underlain by red shale.	Between Lueders Limestone and Beaverburk Limestone.	
2473	Wichita	Unknown	-	F-39323	Grab	0.010	-	0.02	0.09	Carbonaceous zone in phosphatic material; within an interbedded series of sandstone and shale.	In Beaverburk Limestone.	
2468	Wichita	Bradley Ranch	242611 242672 244052	F-36936 (lower zn) F-36937 (upper zn) F-36939	Chip Chip Grab	0.046 0.002 0.096	0.053 - 0.111	0.015	1.1	Limonite and hematite staining in sandstone; within thick siltstone channel.	Approximately 30 ft. below the Beaverburk Limestone.	Se 1.0 ppm
2471	Wichita	Schmocker Farm	None	Taken				0.008	0.08	Ferruginous nodules in the soil.	Probably between Beaverburk Ls. & Coleman Junction horizon.	
2424	Wichita	Unknown	229934	F-39268	Grab	0.012	-	0.02	0.06	Ferruginous sandstone, thin bedded within red sandstones and shales.	Between Beaverburk Ls. & Coleman Junction horizon.	
2477	Clay	Taylor Estate	-	F-39316	Grab	0.007	-	0.01	0.09	Sandstone, ferruginous, thin bedded corrugated. Copper present.	Between Beaverburk Ls. & Coleman Junction horizon.	
2427	Clay	Ship	229925 229926	F-39259 F-39260	Grab Channel	0.025 0.008	- -	0.02	0.1	Sandstone with some carbon and copper. May be in fault zone.	Between Beaverburk Ls. & Coleman Jct. hzn.	
2456	Clay	Chrisman Ranch	-	-	Grab	.01	-	0.005	0.03	Sandstone, friable, some carbon & copper. Within indurated sandstone.	Between Beaverburk Ls. & Coleman Jct. hzn.	
2472	Archer	Boone	None	Taken				0.03	0.20	Shale, grayish green, some copper; within brownish-red shale sequence	Between Beaverburk Ls. & Coleman Jct. hzn.	
2416	Clay	Hatfield Estate	229867	F-39255	Grab	0.020	-	0.025	0.07	Sandstone, ferruginous, thin, lenticular.	Between Beaverburk Ls. & Coleman Jct. hzn.	
2422	Clay	Smith	229930 229931	F-39264 F-39265	Channel Grab	0.001 0.046	-	0.025	0.3	Sandstone, ferruginous, thin, concretionary.	Between Beaverburk Ls. & Coleman Jct. hzn.	
2437	Clay	Franklin	None	Taken				0.035	0.045	Sandstone, some copper, underlain by red shale.	Between Beaverburk Ls. & Coleman Jct. hzn.	

TABLE 2 (continued)

AEC File No.	County	Property Name	Sample Data Serial No.	Field No.	Type	eU3O8%	cU3O8%	Radioactivity Background (MR/hr)	Maximum (MR/hr)	Lithologic Description	Stratigraphic Position	Remarks
2470	Archer	Boone Ranch	-	F-39307	Select	0.041	-	0.02	0.07	Sandstone, ferruginous, fossil fragments (phosphatic), no material in place; in reddish-brown shale.	Between Beaverburk Ls. & Coleman Jct.hzn.	
2461	Archer	Parkey Ranch	-	F-39327	Grab	0.032	-	0.005	0.25	Sandstone, ferruginous, mottled brown; within gray sandstone underlain by maroon & gray shales.	Between Beaverburk Ls. & Coleman Jct. hzn.	Airborne anomaly
2475	Clay	Staley Ranch	-	F-39638 27728	Grab Chip	0.039 0.036	0.036	0.01	1.0	Sandstone, brown, some iron staining; sandstone caps red shale hills.	Between Beaverburk Ls. & Coleman Jct. hzn.	Airborne anomaly
2469	Archer	Coleman Ranch	58520 244052	F-39304 F-36939	Grab Select	0.054 0.054	0.031 0.021	0.01	0.50	Clay, ferruginous, carbonaceous, in gray-yellow sandstone underlain by red shale.	Between Beaverburk Ls. & Coleman Jct. hzn.	Se 2.0 ppm
2460	Clay	Scaling	-	F-39240	Grab	0.021	-	0.005	0.03	Sandstone, ferruginous, caps low hills of red shale.	In sandstone above Coleman Junction horizon.	
2459	Montague	Castleberry Farm	-	F-39239	Select	0.019	-	0.01	0.05	Ferruginous nodules in thick light-gray sandstone.	Below Coleman Jct. horizon.	
2447	Archer	Abercrombie Ranch	237528	F-39393	Select	Not (mineral identi-ficatio	run n)	0.005	0.05	Radioactivity associated with copper minerals and hematite in light- to dark-gray sandstone capping red shale hills.	Below Coleman Jct. horizon.	Sparse yellow uranium mineral identified as carnotite.
2483	Archer	Martin	None	Taken				0.014	0.1	Sandstone and conglomerate, reddish brown, ferruginous, some carbonaceous material.	Below Coleman Jct. horizon.	Airborne anomaly
2458	Montague	Blevins Ranch	58516	F-39238	Select	0.388	0.308	0.005	0.40	Sandstone, carbonaceous with some copper. None in place. Host rocks, light-gray sandstone in channel underlain by red shale.	Below Coleman Jct. horizon.	Small blebs of torbernite
2436	Montague	Brooks Estate	-	F-39379	Grab	0.011	-	0.035	0.35	Ferruginous concretions in dark greenish-gray sandstone.	Below Coleman Jct. horizon	
2439	Montague	Howard Estate	52087	F-39378	Grab	0.029	0.045	0.035	1.2	Sandstone, light-gray, fine-grained underlain by radioactive gray shale, heavy soil cover.	Below Coleman Jct. horizon.	Nil % V_2O_5
2476-N	Archer		-	27727	Grab	0.075	0.001	0.007	0.30	Sediment from sump of producing oil well.	Well produces from Thomas Sand of the Cisco Group.	Airborne Anomaly
2476-S	Archer		None	Taken				0.007	0.30	Sediment from sump of producing oil well.	Well produces from Thomas Sand of the Cisco Group.	Airborne Anomaly

TABLE 3

OCCURRENCES OF RADIOACTIVE DEPOSITS IN THE RED RIVER REGION OF OKLAHOMA

AEC File No.	County	SAMPLE DATA: Property Name	Serial No.	Field No.	Type	eU_3O_8(%)	cU_3O_8(%)	Radioactivity: Background MR/hr	Maximum MR/hr	Lithologic Description	Stratigraphic Position	Remarks
2438	Comanche Sec.34,T1N, R15W	Kinder Ranch	-	F-39377	Grab	0.010	-	0.04	0.45	Arkosic sandstone, coarse-grained. 3-10 ft. in thickness. Underlain by red and gray mud-stone and shale.	Above t bed. Garber Sandstone equivalent.	
2426	Cotton,SE 1/4, Sec.7,T4S, R12W	Sutterfield & Wilson (Crow)	229869 229870	F-39257 F-39258	Select Select	0.089 0.033	0.073 -	0.025	0.5	Sandstone and conglomerate, abundant copper carbonates and some plant remains. Some lig-nite and clay present.	t bed	
M-1591	Cotton,SW 1/4, Sec.30,T5S, R12W	Byers Farm (Eastman)	-	-	-	-	-	0.01	0.35 (Avg.)	Sandstone, contains torbernite, autunite, uranophane, carno-tite, and other uranium minerals with associated copper sulfide minerals.	t bed	
2805	Jefferson SW 1/4,Sec.13, T7S, R6W	Smart Ranch	229928 229929	F-39262 F-39263	Channel 1-ft. Grab	0.005 0.034	- -	0.02	0.08	Sandstone, calcareous, thin, thin, contains specks of asphaltite(?) or carbon.	Below Ryan Sandstone zone	
F-39266	Jefferson NE 1/4,Sec.9, T7S, R6W	O'Neal	229932 229933	F-39266 F-39267	Grab Chip	0.026 0.012	- -	0.02	0.06	Sandstone, containing cupri-ferous fossil plant debris and bituminous material.	Below Ryan Sandstone zone	
2803	Jefferson Sec.16,T6S, R4W	Unknown	-	-	-	-	-	0.01	0.04		Below Ryan Sandstone zone	
2440	Jefferson Sec. 12,T5S, R9W	Miller Ranch	52086	F-39376	Select	0.052	0.070	0.03	0.15	Ferruginous sandstone, fine-grained, dark red.	Ryan Sandstone	Nil % V_2O_5
C-1640	Jefferson Sec.23, T6S, R5W	Howard	-	-	-	-	-	0.025	0.08	Ferruginous concretionary zone.	Below Ryan Sandstone	
C-1638	Jefferson NE 1/4, Sec.1, T5S, R9W	Cronley	-	-	-	-	-	0.015	0.04	Ferruginous sandstone, medium-grained	Ryan Sandstone	
C-1639	Jefferson Sec. 4,T6S, R5W	Seay	-	-	-	-	-	0.025	0.20	Ferruginous sandstone, medium-grained.	Below Ryan Sandstone	
2804	Tillman SE 1/4,SE 1/4, Sec.1,T1S, R16W	Barnett Farm	-	-	-	-	-	0.005	0.035	Arkosic sandstone, ferruginous coarse-grained.	Above t bed. Garber Sandstone equivalent	Large area underlain by radioactive soil.
M-1586	Tillman and Commanche Sec.1,T1S, R15W Sec. 31, T1N,R15W	Mathis-Oberlender	53799	F-39392	Grab	0.055	0.012	0.01	0.30	Arkosic sandstone, ferruginous, coarse-grained.	Above t bed. Garber Sandstone equivalent	Sparce flakes of a yellow uranium mineral, prob-ably carnotite.
M-1592	Tillman, NW 1/4, Sec. 6 T1S, R15W.	Ray	-	-	-	-	-	0.025	0.11	Arkosic sandstone, ferruginous, coarse-grained.	Above t bed. Garber Sandstone equivalent	

sandstones, siltstones and conglomerates and 6 are in shales. The remainder consist of sumps from producing oil wells, concretions in soil and phosphatic material. Most of the sandstones which contain deposits are paleo-stream channels. These relatively thick elongated sandstone lenses range from 5 to 30 feet thick and have an areal extent of up to several acres. Several deposits are in arkosic, granite wash fanglomerates. Preliminary reconnaissance reports for the Oklahoma and Texas localities have been published by the AEC (1968, 1970).

Structure

Fractures, faults and other deformation were not important factors in the formation of most deposits. Exceptions are the Ancell locality in Wichita County, where uranium is localized along a minor fracture and, in the Taylor locality of Clay County, a mineralized thin-bedded sandstone is corregated, apparently owing to compressive forces.

Mineralogy

The most common uranium mineral in the Red River region is probably carnotite, which was observed at five localities.

Two are in Clear Fork rocks in Wilbarger County, Texas, and the remaining are in Wichita rocks: at the Abercrombie Ranch in Archer County, Texas; in arkosic, granite wash conglomerate on the Tillman-Comanche County line, and on the Clinton Byers farm in the Red River bluffs in Cotton County, Oklahoma. A green mineral, probably torbernite, was found near Ringgold in Montague County, Texas

The uranium minerals are generally associated with copper minerals and/or iron staining. The most common copper minerals found in the Red River region (in order of decreasing abundance) are malachite, azurite, and chalcocite. Radioactivity emanates both from and adjacent to copper deposits. On the Byers farm, torbernite, autunite, uranophane and bayleyite(?) are found associated with malachite and azurite in the lower ten feet of the 25-foot thick sandstone lenses (Beroni, 1956). Small amounts of uraninite, galena, pyrite and chalcopyrite are found associated with woody fragments in the sandstone.

An increase in radioactivity generally corresponds with an increase in intensity of ferruginous staining. In many localities the uranium minerals are found in ferruginous concretionary nodules. These nodules range in size from less than one inch to several feet in diameter.

Many of the deposits contain carbonaceous material, mainly plant fragments, which appear to localize the radioactivity. The plant fragments are commonly replaced by copper minerals.

Characteristics of the Uranium Deposits

(1) Calcium carbonate cement is characteristic of the deposits, however, the arkosic, granite wash fanglomerates are commonly cemented by silica, generally opal-zeolite.

(2) The deposits are located generally in gray or pale colored beds.

(3) Sulfide minerals are present but not associated with hydrothermal minerals or with the related quartz or other gangue.

(4) The uranium minerals commonly replace or are adjacent to carbonized plant remains.

(5) Iron oxides and copper minerals (principally malchite replacing chalcocite) are generally abundant in the deposits.

(6) The uranium is generally found in sandstone lenses.

Radioactive Oil Well Sumps

Two slush pits that contain a thin layer of radioactive residue were discovered during the airborne survey. These pits received water separated from the oil produced from nearby wells in the Thomas Sand, a local zone in the Cisco Group. The slush pits are located in Archer County, Texas, approximately 5 miles east of Holliday (Plate 1).

One sample contained 0.075 percent eU_3O_8 and less than 0.001 percent U_3O_8. The radioactive residue may be similar to other residue found in some oil fields in southeastern Kansas (Gott and Hill, 1953), the Texas panhandle (Pierce and others, 1956), and northeastern Oklahoma (Hail, 1957).

RESULTS OF AIRBORNE RADIOMETRY

Five radioactive anomalies were discovered from the air (Table 2 and Fig. 1). Three anomalous localities are in Archer and Clay counties, Texas. The occurrences are stratigraphically close to the Coleman Junction horizon and are in ferruginous sandstones (Nos. 2461, 2475, and 2483 in Table 2 and Plate 1). The two remaining localities (Nos. 2476N and 2476S) are the radioactive oil well sumps in Archer County described above. No previously unknown radioactive deposits were discovered in Oklahoma. All other anomalous localities listed in Tables 2 and 3 shown on Plate 1 were known through previous work.

Records were made of the entire area flown (Fig. 1), with the exception of Archer County and the northern half of Montague County, Texas. Relatively small and gradual variations in the radioactivity, and instrumental errors made difficult the construction of an isoradiometric map. In terms of microamperes on a zero to two hundred microampere meter, the maximum reading obtained in Oklahoma was slightly over 120, and the minimum approximately 75; the maximum and minimum readings in Texas were approximately 90 and 60, respectively. Unfortunately, this difference is due to recalibration of the detection instrument and the data is insufficient to reduce the measurements in the two areas to a common base.

On Plate 1, areas in Oklahoma exhibiting radioactivity greater than 100 microamperes are shaded; while in Texas, the areas registering radioactivity greater than 70 microamperes are shaded.

It will be noted on Plate 1 that some of the shaded areas which represent high background are elongated north-south, the same general direction as the flight lines. Some of this north-south distortion is due to instrumental errors, caused principally by daily variation in atmospheric humidity and a decrease in sensitivity of the detection instrument with time.

Little correlation can be made between background radioactivity and geology (Plate 1). In the Red River region, mappable geologic contacts are relatively few, and variations in the thickness of soil cover and the lithology of bedrock is very complex. There appears to be a general relationship between known radioactive occurrences and greater than average background

CONCLUSIONS

Origin of the Ore

The uranium minerals were deposited by solutions, probably groundwater, which contained iron and copper in addition to uranium. The solutions moved laterally along the more porous sandstone beds. The uranium precipitated near carbonized plant material which had been deposited along with the coarser sand fraction in Permian stream channels.

Favorability for New Discoveries

Prospecting by private interests and the AEC has not revealed uranium deposits that could be mined at a profit. Potential host rocks are the larger sandstone lenses, generally do not exceed a few hundred yards in length. The arkosic, granite wash conglomerates south of the Wichita Mountains are more extensive potential host rocks.

The size of most of the potential ore deposits are limited by erosion of the host rock. Three properties which warrant further exploration are the Bradley Ranch in Wichita County (Table 2, No. 2468), the Blevins Ranch (Table 2, No. 2458) and the Howard Estate (Table 3, No. 2439), both in Montague County. On these properties samples selected from mineralized channel-like sandstone lenses assayed over 0.045 percent U_3O_8. The Mathis-Oberlender property, ten miles west of Manitou, Oklahoma, along the Comanche-Tillman County line (Table 3, No. M-1586) also warrants further exploratory work as radioactivity is very high. This deposit is in an arkosic, granite wash conglomerate in the upper Wichita Formation.

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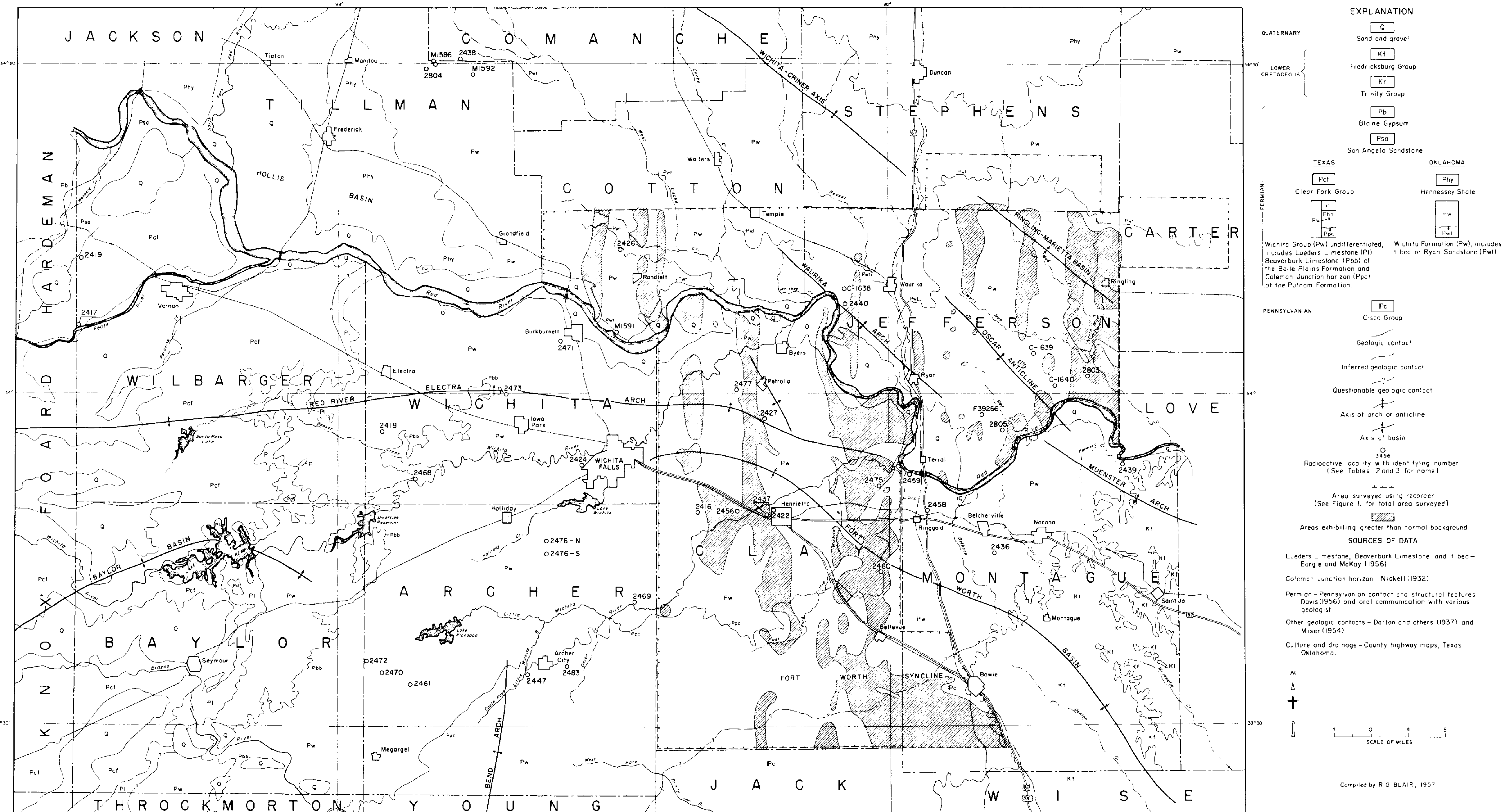

PLATE I. GEOLOGIC MAP OF THE RED RIVER REGION, TEXAS AND OKLAHOMA - SHOWING RADIOACTIVE LOCALITIES IN PERMIAN ROCKS