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TITLE: FRACTURE COATINGS IN TOPOPAH SPRING TUFF ALONG DRILL HOLE WASH

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Fracture Coatings in Topopah Spring Tuff along Drill Hole Wash

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Introduction

Fracture-lining minerals are being studied as part of site characterization to determine the suitability of Yucca Mountain, Nevada as a potential high level nuclear waste repository. Fracture coatings in the Paintbrush Group provide information on potential flow paths above the water table both toward and away from the potential repository and provide information on the distribution of fracture-lining minerals needed to model thermal effects of waste emplacement. Fracture coatings within the predominantly non-zeolitic Paintbrush Group vary both with depth and laterally across Yucca Mountain, whereas fracture coatings in tuffs below the Paintbrush Group are related to the mineralogy of the tuffs and follow a consistent pattern of distribution with predominantly quartz, calcite, and manganese oxides in the devitrified intervals and mordenite and clinoptilolite in the zeolitic intervals (1). The zeolites stellerite and heulandite are more abundant in fractures in the Topopah Spring Tuff in drill holes USW G-1 and UE-25 a#1, located along Drill Hole Wash (at the northern end of Yucca Mountain, Figure 1), than in core from other parts of Yucca Mountain. Buesch et al. (2) present evidence for a complex fault system along Drill Hole Wash. To investigate the possibility that the abundant fracture-lining zeolites in USW G-1 and UE-25 a#1 are related to the Drill Hole Wash fault, the Topopah Spring Tuff was examined in drill cores from USW UZ-14, USW G-1, USW NRG-7/7a, and UE-25 a#1.

Methods

Fracture coatings were examined at up to 50× magnification and representative samples were scraped for X-ray diffraction analysis, which was performed with an automated Siemens D-500 powder diffractometer and Cu Kα radiation. Fragments from selected fractures were examined using an ISI scanning electron microscope with EDX capabilities and a Tracor Northern ADEM SEM.

Results

Fracture-coatings in USW UZ-14 and USW G-1 are very similar (Figure 2). Prismatic zeolites (heulandite and/or stellerite) are abundant throughout most of the devitrified Topopah Spring Tuff. Heulandite occurs higher in the drill holes than stellerite and occurs sporadically with stellerite over the rest of the devitrified interval. Calcite coats one or two fractures within any 30 m interval of devitrified Topopah Spring Tuff. Drill hole UE-25 a#1 fractures contain widespread calcite, and prismatic zeolites coat fractures in the lower 90 m of the devitrified Topopah Spring Tuff, although stellerite was not identified in XRD analyses. USW NRG-7/7a, unlike the other drill holes, contains almost no calcite in fractures, and heulandite is limited to the 25 m immediately above the vitrophyre. No stellerite was identified in this core.

Discussion

Although prismatic zeolites are most abundant in USW G-1 and USW UZ-14, the proposed trace of the Drill Hole Wash fault (2) turns north out of Drill Hole Wash and does not pass close to these drill holes. UE-25 a#1, which is near the trace of the fault, contains abundant heulandite in the lower part of the Topopah Spring Tuff, but USW NRG-7/7a, which is also near the proposed fault, contains the least calcite of any drill core examined to date, no stellerite and very little heulandite. USW NRG-7/7a is also located near an extension of the Ghost Dance Fault and intersects much shattered and broken rock, which intuitively should have provided transport pathways and allowed deposition of calcite and zeolites, but which does not contain these minerals. Either this shattered rock did not provide transport pathways, or flow through these fractures was so unimpeded that fluid drained quickly and minerals did not precipitate.

Conclusions

The abundant stellerite in USW G-1 and USW UZ-14 was not caused by proximity to Drill Hole Wash or any related structure. The presence of shattered and/or broken rock, presumably related to faulting, does not necessarily correlate with deposition of calcite or zeolites. This lack of correlation may indicate that these shattered zones were not transport pathways, or alternatively, that fluid transport was so rapid that no minerals were deposited. Additional studies are required to determine the factors controlling calcite and zeolite deposition in fractures in the Topopah Spring Tuff.

Acknowledgments

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References

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2. BUESCH, D. C., DICKERSON, R., P., DRAKE, R., M., and SPENGLER, R. W., 1994, Integrated geology and preliminary cross section along the north ramp of the exploratory studies facility, Yucca Mountain: Proceedings of the Fifth Annual International Conference on High Level Radioactive Waste Management, Las Vegas, Nevada, May 22-26, 1994.

Figure Captions

Figure 1. Map of the northern part of Yucca Mountain, Nevada, indicating location of core holes, outline of the proposed repository block, and major faults, including the proposed Drill Hole Wash fault. Modified from Buesch et al., (2).

Figure 2. Generalized stratigraphy and distribution of heulandite, stellerite and calcite for the drill holes included in this study. Prismatic zeolites may be heulandite and/or stellerite, and cannot be distinguished at 50× magnification. YM = Yucca Mountain Tuff, vvv = upper vitric interval of the Topopah Spring Tuff, CH = Calico Hills Formation.

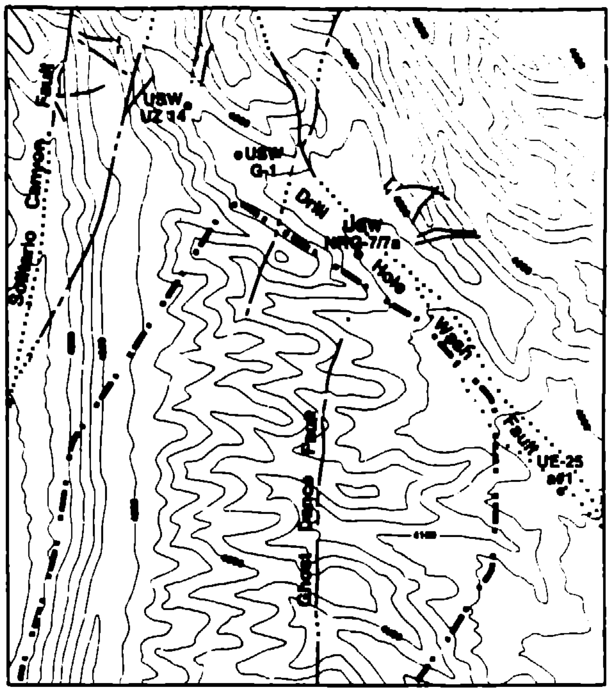
USW UZ-14
USW G-1
USW NRG-7/7a
UE-25 a#1
Solitario Canyon Fault
Drill Hole Wash Fault
Ghost Dance Fault

Figure 1

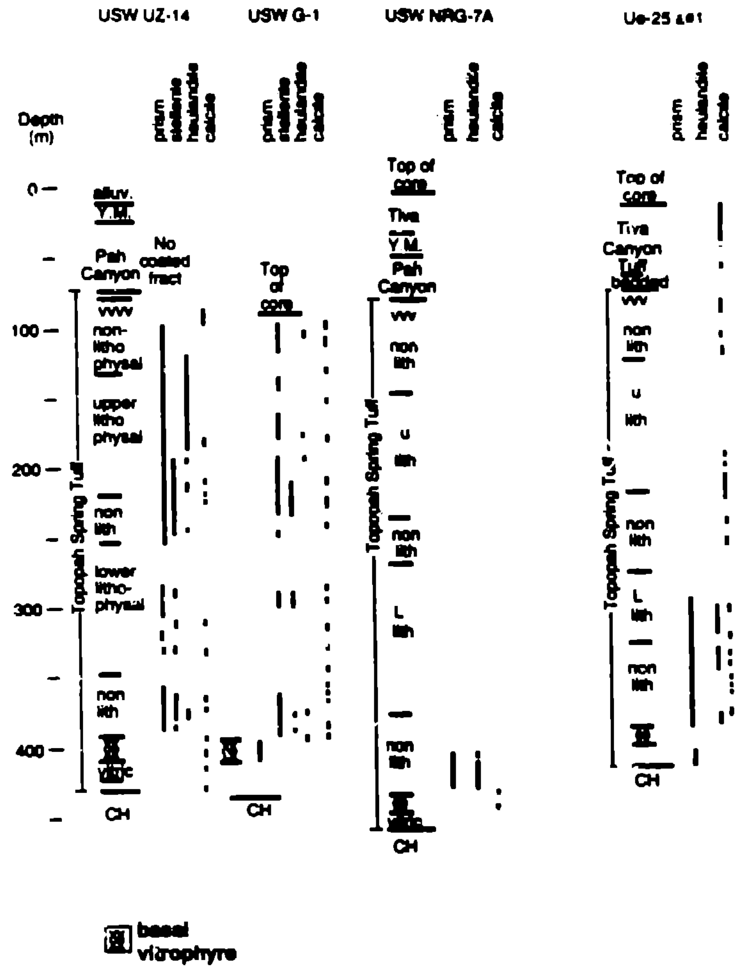
USW UZ-14
USW G-1
USW NRG-7A
Ue-25 a#1
Depth (m)
prism
stellerite
heulandite
calcite
0
100
200
300
400
alluv.
Y.M.
Pah Canyon
No coated fract
vvvv
non-litho physal
upper litho physal
non lith
lower litho-physal
non lith
vitric
CH
Topopah Spring Tuff
Top of core
Tiva
Canyon
Tuff
bedded
u lith
L lith
basal vitrophyre

Figure 2