

ZEOLITIZED TUFFS IN THE HOME-SHEAVILLE AREAS OF MALHEUR COUNTY

CONFIDENTIAL

A summary, by N.S.W. of an
interview and reconnaissance
survey made with U.S.G.S. personnel
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Dick, (R.A.) Sheppard and Jim Gude, the U.S.G.S. team of specialists who recently completed an extensive study of the zeolitized tuffs in Death Valley, California, have just made a preliminary appraisal of similar materials in the Jordan Valley and Rome areas of Malheur County. They left Oregon for Pine Valley, Nevada (south of Carlin) to inspect another locality. Following that they are scheduled to visit two other areas in Arizona and one in New Mexico.

Supposedly they intend to select one of the localities in one of these four states for a continued study of the whole zeolitization process on a comprehensive, grass-roots level. Which area they will elect to work will depend, of course, on what each has to offer; that is, the number and kinds of zeolites present, the size of the occurrence, quality of exposures, etc. Their field reconnaissance should be completed during the next two weeks and follow up lab studies during the next succeeding two months, after which they should be in a position to make a decision. In any event, they say they will advise us concerning their selection of an area as soon as the decision is made.

Regarding their Malheur County examination, I can advise that they stated many times that they were both surprised and greatly impressed by what they saw. What they were surprised by was the enormity of the occurrences from the standpoint of the acreage covered and the manifestly great thickness of the section of zeolitized material. What they were impressed by was the diversity of zeolitic materials present and indications that important data bearing on the subject of genesis might well be present, especially with respect to gradation within the section between zeolites, migration of silica and variations in the salinity of the water in the direction of increased salinity during the end stages of the process, etc. It is also apparent that the zeolitized material ranges from initially pure tuff to water-deposited components containing grains of various non-glassy materials and this contributes an element of added interest to the total picture.

Still other factors bearing on their favorable reaction to the area are (1) the presence of commercially important kinds of zeolite, (2) the industrial interest being shown in same, and (3) realization that the two occurrences visited represent only a partial sampling of the total potentially available for study.

What follows in the succeeding sections is a description in greater detail of the Rome and Sheaville areas, comments concerning present industrial activity in connection with said areas and a section outlining miscellaneous bits of data bearing on the subject of mass zeolitization and the economics thereof as garnered from remarks made by Sheppard and Gude.

Roma occurrence: Geologically, the zeolitized beds in this locality occur within the area occupied by the formations designated as "Tst" on the new geologic recon map made by Walker and Repenning (USGS Map 1-457). This is described as being comprised of "Tuffaceous sedimentary rocks, tuffs, and interbedded basaltic and andesitic flows". The assigned age is "Pliocene".

The uppermost of the zeolitized beds is an Erionite strata. This is 2 to 4 feet thick, widespread in its occurrence and apparently quite pure. Underlying this is a 20 plus feet thick strata of highly zeolitized tuff probably made of both Mordenite and Clinoptilolite. A 4 to 5 inch parting of what may prove to be Chabasite is commonly found near the base, and throughout, and especially near the top, there is abundant evidence of dissolved-out saline crystals which Sheppard and Gude regard as extremely significant geologic data. Continuing down in the section the tuff grades into a more bedded, sedimentary phase that is indefinitely thick. This contains an abundance of glass that is now also zeolitized and a comparatively small amount of other sedimentary grains. Whether Phillipsite is present in this horizon couldn't be ascertained with certainty on visual examination; however, its presence is considered expectable.

Overlying the Erionite bed there is a mudstone that ranges from zero to 15 or so feet thick. This in turn is capped in places by a thin basalt which is the topmost rock unit in the immediate area. Otherwise, the Erionite is directly exposed over a large area and the successively lower beds over an even larger area in accordance with erosional circumstances.

The location of this occurrence by legal subdivision may be described as comprising most of the area occupied by "Tst" in T 31 S, R 41 E and also in the adjoining NW $\frac{1}{4}$ of T 32 S. An excellent exposure of the Erionite bed and much of the underlying Mordenite-Clinoptilolite tuff is present adjacent to highway 95 in T 32 S just where the road south from Rome starts the downgrade to the Crooked river. Samples No. 1, 2, 3, and 4 originate from this location.

Sheaville occurrence. Geologically, the material here may correlate with Walker's "Tst" formation at Rome and elsewhere in the Jordan Valley area. Then again, it may not and the uncertainty is due to the location being out of Walker's mapped area by a distance of some eleven miles north from the nearest mapped "Tst" around Jordan Valley. The chances are that the Sheaville occurrence represents the "Tst" formation, however.

Regardless of the age, the significant thing is that the material here is thoroughly scotitized and has all the earmarks of being Meridenite and not Glinophilolite. Furthermore, the accumulation is obviously enormously thick -- so much so that Shepard and Gade marvelled aloud many times about never having seen or even heard of any such tremendous development in any single occurrence. In the absence of mapping and because of poor natural exposures throughout the surrounding country at large, no definitive statement can be made at this time concerning the area underlain by this material other than that it probably extends through several sections. In any event the observed occurrence is obviously of mineable size should eventual study show the material to be industrially usable.

Specifically, this location is on highway 95, on the east side thereof and at a point 2 miles north of Sheaville. This makes it in the northeast corner of T 28 S; R 46 E, sections 1 and 12.

Commercial interest: Mining claims (Placer) taken by a Mr. Bag's, February, 1965, cover most of the exposed and readily accessible beds in both the Rome and Sheaville localities. These number an estimated 25 to 30 in the Rome area and 7 to 10 in the Sheaville area. They are marked conspicuously with 2 x 4 posts (not 4 x 4's) and by dozer-made discovery holes. Additional work in the form of drilling had just been completed on the Rome Group at the time of our visit. This was done by Boyles Brothers, drilling contractors out of Salt Lake, and in fact, they just pulled their rig off the ground the morning of the day (Sunday, Sept. 11) we made our visit. According to native informants the drilling had gone on over a two-week period and the usual hole depth was on the order of 50 feet. From this evidence on the ground we infer that cores were taken at least part of the time. On the Sheaville claims there was no evidence of drilling. Instead, however, there was an extensive amount of recent dozer work evidently performed here as a substitute for drilling.

Regis identified with the Norton Abrasive Company according to Sheppard, and also according to Sheppard, the Norton Company rates as a longtime manufacturer of synthetic zeolites. Under the circumstances they are understandably interested in the natural product now that tuffs zeolitized in bulk are known to exist, all the more so, perhaps, since some of their synthetic product has been selling at \$800.00 per ton.

Sheppard and Gude have a low opinion of Norton because (1) at scientific meetings they have publically announced that all zeolitized tuffs have the same chemical composition and that the zeolitization is due to younger basalts, because (2) they tend to defend these conclusions belligerently and blindly without giving conclusive proof of their contentions and in spite of the existence of abundant data indicative of other conclusions, and finally, because (3) they are close when it comes to giving out data yet want the Survey to clear with them before any Survey studies are published. How valid these criticisms are, I have no way of judging except to the extent that Sheppard and Gude impressed me as being open-minded, fair and scientifically objective in all that they said and did in my presence, and I liked them both. Besides, Sheppard and Gude both mentioned Shell and Curry on several occasions and in all instances all remarks indicated cordial, wholesome relationship between all parties. Thus, I suspect that there is in fact some justification for the attitude expressed towards Norton.

Supposedly Shell has claims in the Rome area. We as a department have reason for believing so. Sheppard and Gude do also and Jordan Valley residents questioned concerning the point recognize Shell as being active in the area. However, no informant was found who could pin-point the location of Shell's activity, nor did we observe any Shell claims either at Rome or at Sheville. If any exist, their location thus remains a mystery as the Norton claims cover the bulk of the prime and readily accessible material in both the Rome and Sheville areas. This gives rise to the speculation that Shell may have acquiesced to the idea of leasing and therefore abandoned their claim efforts, or else that their claims are not conspicuously posted, or else that they are located on some outlying and un-visited Tst occurrence.

The Claim vs Lease question: Sheppard and Gude are cognizant of this question and of Wayland's stand. Furthermore, they tend to support Wayland when the subject is discussed. At the same time they admit to the existence of certain contradictions, as follows:

- (1) Tuffs altered practically 100% to K-feldspar are similar to zeolitized tuffs, yet the K-feldspar tuffs are considered locatable and are even now being held and developed in the Death Valley area.
- (2) The potential commercial users of zeolitized tuffs, especially those using it in connection with gasoline manufacture from crude petroleum, don't want the Na part of the zeolite at all and in practice would actually subject the raw material to treatment (cation exchange of Na for H) prior to use.

Some of the difficulty here stems from recent experience in Colorado where oil shales subject by definition to lease are now being located by claim for other minerals not related to the oil angle. I gather that the locations are theoretically legitimate although utterly incompatible to the recovery of oil. The net effect, therefore, is that the U.S.G.S. is more than ordinarily jittery because the way it now stands they have both lessees and claimholders on their hands, both asserting right to the same cubic foot of shale but each for a different objective. At least this is what Sheppard and Gude indicated.

General economics: Erionite, mordenite, chabazite and phillipsite are considered as the zeolites of prime commercial potential. This is because of their superior open lattice. In fact, chabazite is now being mined in Arizona by Lindy, and Norton is in the last stages of developing another occurrence for operation if indeed they are not already in production. Clinoptilolite is no longer regarded favorably. Several large, pure occurrences are now known, including one in Death Valley adjacent to rail transport. However, all stand idle in deference to occurrences of the types listed above, and for the reason cited above.

Mineralogy: As a result of their prolonged experience with the problem, Sheppard and Gude feel that it is possible to make fairly reliable guesstimates concerning the probable identity of the zeolite in a given well-zeolitized tuff. First of all, and due to its greater loss of SiO_2 ,

Phillipsite generally tends to be found at the base of a section and erionite at the top. The other zeolites range in between. Off-beat, but usable criteria, for field recognition of one type against the other is as follows:

Erionite: When hit a good blow with the point of a pointed sample pick, the pick will embed and tend to stay stuck to the extent that some prying is necessary to free it. This is a distinctive characteristic not found in the instance of the other zeolitized tuffs.

Clinoptilolite: Practically always exhibits conspicuous conchoidal fractures.

Mordenite: Almost never exhibits conchoidal fractures.

Phillipsite: Very frequently, but not always, shows an oolitic-like texture, at least in places if not everywhere. Never conchoidal.

The foregoing characteristics are significant only in the instance of highly zeolitized tuffs where 90 percent or better of the rock is zeolite of one kind or another. Tuffs with lesser zeolite contents become correspondingly less distinctive. Color is totally unreliable.

Specimens: Four specimens from the Rome area and one from the Sheaville occurrence are being submitted with this report. Each is named on an accompanying label. However, in fairness to Sheppard and Gude, it should be remembered that these identifications are tentative field hunches at this stage of the game and based solely on experience as exemplified by the above-cited characteristics. In short, while the lads are serious in feeling that these criteria are meaningfully indicative, laboratory confirmation still rates as essential. Therefore, out of courtesy, these specimens should NOT be displayed formally until laboratory confirmation of their identities is available.

Re-cap and conclusions: Several types of zeolitized tuffs are represented in the Rome-Sheaville occurrences and at least some of these are clearly widespread and thick to a virtually unprecedented extent in terms of present knowledge concerning occurrences of this type. Furthermore, there is a mapped abundance of the host Tst formation in the upper Owyhee area; hence the likelihood that the existence of additional occurrences may be disclosed by additional study. In addition, the Rome-Sheaville occurrences contain some of the commercially important kinds of zeolites and these are already being sought out by important industrial users. I think, therefore, that because of the sum-total of these factors the U.S.G.S. really wants to make a special project study in the area and that they will seriously consider doing so providing a deterioration of relations with Norton does not cause them to back off. This I think they do regard seriously and with at least some apprehension. What they find in Nevada, Arizona and New Mexico will, of course, also influence their decision. However, from the enthusiasm they exhibited over what they saw in the Rome-Sheaville area I gather that they were favorably impressed beyond their fondest expectations. In any event, they have agreed to advise us concerning their intentions, one way or another, as soon as a decision is made. And if they do take on the project, what they have in mind doing will rate as a truly comprehensive study.

One other point deserving of mention is that they, the U.S.G.S., have already quietly screened central Oregon. Sheppard mentioned having visited two small chabazite occurrences and I gather that he has had considerable communication and even field trips with Dick Hay and Waters and others. He also spent time based at Hood River a couple of years ago mapping either the White Salmon or Wishram quad (I forget now which) and I infer that he made some side trips into central Oregon even then, sizing up the zeolitized tuff situation, that is.

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SAMPLES (All identification tentative)

Rome Area:

- #1 Erionite
- #2 Clinoptilolite
- #3 Mordenite (with casts of saline crystals)
- #4 Phillipsite

Sheaville Area:

- #5 Mordenite