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FIELD NOTES FROM THE ARIZONA BUREAU OF MINES

Vol. 3 No. 2 Earth Science and Mineral Resources in Arizona June 1973

EVAPORITE DEVELOPMENTS THICKEST ANHYDRITE IN THE WORLD?

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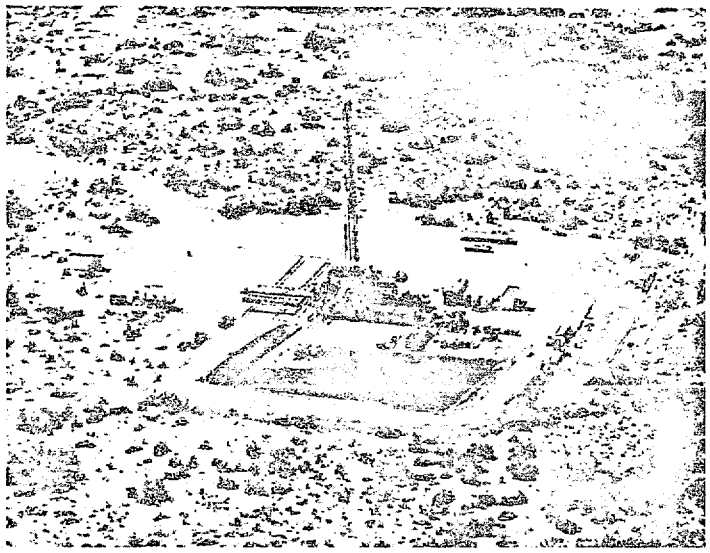
Recently, I delivered a paper, "Halite Masses In The Basin and Range Province, Arizona", at the Fourth International Symposium on Salt held in Houston, Texas, April 9-12, 1973.

Interest in these is high because their geologic history greatly influences the nature of possible associated resources. Salt, like any other rock or mineral, grows or accumulates in response to an environment. Learning about the applicable environment in which these mases grew is a prerequisite to judging the possibilities of there being associated substances of potential economic value. Much of Texas oil is closely related to salt phenomena—salt that originated from the evaporation of large volumes of sea water. On the other hand, the famous California borate (Twenty Mule Team) and brine occurrences (Searles Lake) represent salinity features developed from non-sea waters. Both the Great Salt Lake and Salton Sea represent concentration of salts by the evaporation of continental and not sea waters. The Salton Sea represents evaporation of normal Colorado River water that overflowed in the early 1900's. Repeated overflow and evaporation could result in evaporite accumulation to the point where the basin is filled. Should subsidence continue to create additional basin capacity, then a potential would exist for the build-up of thick primary evaporite deposits.

The two salt masses of current interest occur near Red Lake in Mohave County (see FIELDNOTES, Vol. 2, No. 1, p. 4) and near Luke Air Force Base a few miles northwest of Phoenix (Peirce, 1972). Both masses, being thousands of feet thick, are notable geologic features. Information about them is fragmentary but geologists are trying to piece the story together—sometimes with a healthy contrast in results. A new piece in the puzzle is given below. Exxon recently announced curtailment of their petroleum exploration effort in southern Arizona (FIELDNOTES, Vol. 1, No. 4, p. 6). After extensive geophysical work in selected valleys or basins, they drilled four holes. The first was drilled in Sec. 2, T8S, R8E near Eloy, Pinal County. Previous information had indicated that the here-named *Picacho Basin,* a slightly east of north depression about 30 miles long and 9 miles wide, contained some evaporites in the form of gypsum ($CaSO_4.2H_2O$) and halite (common salt—NaCl). Until Exxon's State (74) no hole had completely probed the rock sequence in the basin. Prior to the salt symposium meetings, I contacted an Exxon representative, Mr. Ben Stanley of Midland, Texas, in regard to the possible release of data about this hole. Mr. Stanley called to say that company officials had agreed to release certain data to me and that I was free to release it as I judged fit. These data, recorded below, were presented at the meetings. We wish to thank Exxon for their generous cooperation and Mr. Stanley for his expedition on our behalf.

Exxon's State (74) spudded on June 8, 1972 at a ground elevation of 1580 feet above sea level and terminated on July 14, 1972 at a depth of 10,177 feet. The elevation of the bottom of the hole is 8597 feet below sea level. The generalized section cut is:

DEPTH—FEET	ROCK TYPE
0-660	Sand and gravel
660-2335	Clay, monor gypsum and anhydrite halite 2140-2220
2335-8320	*Anhydrite* ($CaSO_4$), minor shale
8320-9060	Conglomerate
9060-9670	"Basalt"
9670-9880	Conglomerate (pebbles of gneiss)
9880-10177	Gneiss



Exxon's State (74), Pinal County, Arizona.

It is to be emphasized that almost 6,000 feet of anhydrite and but 80 feet of salt were cut. At Luke, the situation is reversed, there being at least 6,000 feet (estimated) of salt overlain by 60 feet (estimated) of anhydrite. It seems quite likely that the thick halite at Luke and the thick anhydrite at Picacho are linked through a closely related geologic history in central southern Arizona.

The Picacho hole is about five miles west of the Picacho Mountains, the southern half of which consists of gneiss (a metamorphic rock), probably of Precambrian age. The highest point on the gneiss is Newman Peak at about 4,508 feet above sea level. The relief on the surface of the gneiss, as determined by this peak and the top of the gneiss in the hole, is 12,808 feet. It is likely that the hole did not penetrate the deepest part of the Picacho Basin.

Mr. Stanley further indicated that the oldest materials above the Precambrian are no older than middle Tertiary and that there is no evidence to suggest that marine strata were penetrated. Although a search of the literature has not been made, he thinks it possible that this sequence of anhydrite might be the thickest yet known in the world.

In a paper given last year (Peirce-1972) I suggested that: (1) salt was formed and positioned in Tertiary time; (2) the salt accumulated in rapidly subsiding closed basins associated with the Basin and Range disturbance; (3) the salt is non-marine and late Tertiary in age; (4) salt is laterally partitioned from thick lacustrine (lake) limestones, thick fine-grained clastics, and

possible thick sulfates.

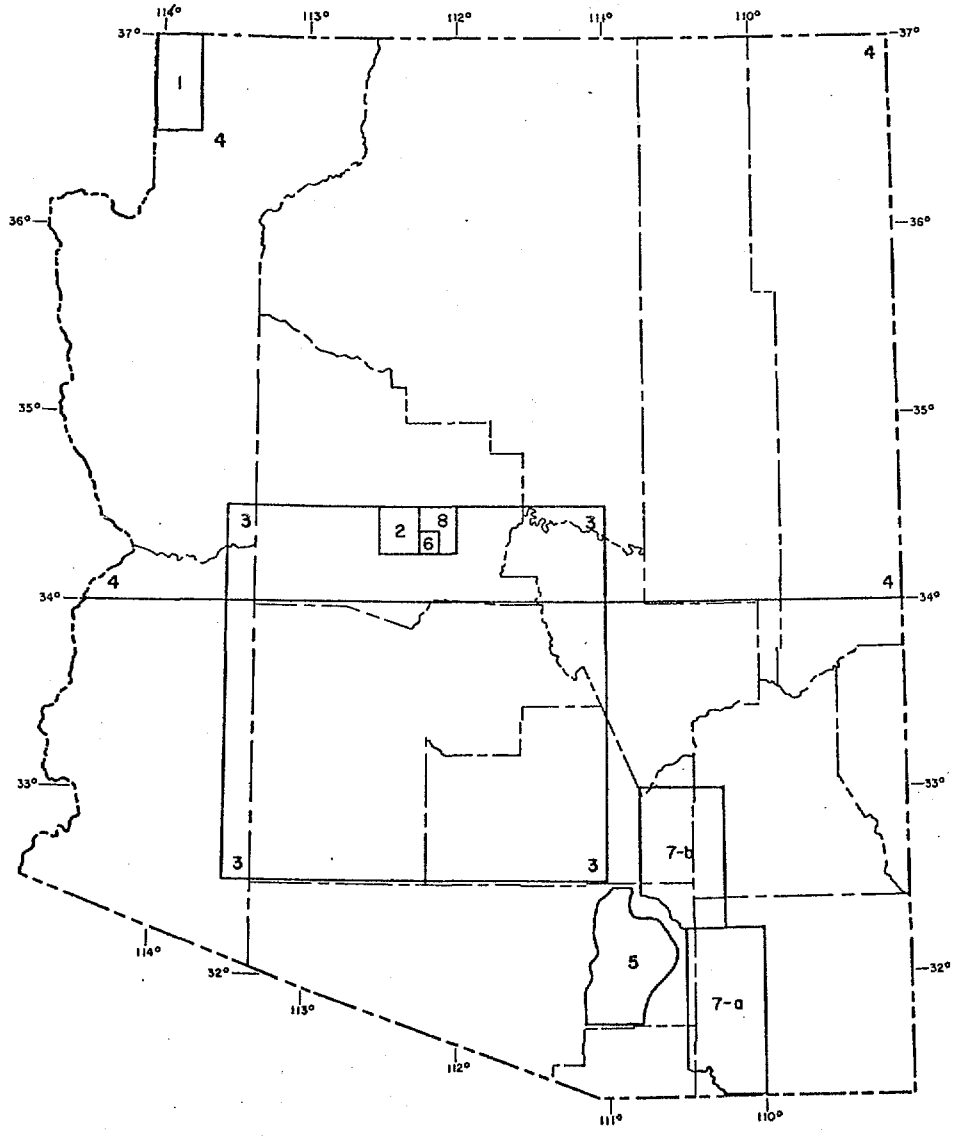
The data thus far obtained from the EXXON Picacho Basin test do not appear to modify these tentative conclusions.

The Red Lake and Luke Salt masses are being evaluated as possible underground storage sites for liquid petroleum products such as butane and propane. Salt in the Permian Supai Formation is already being utilized for this purpose along the Santa Fe Railroad east of Holbrook, Arizona. Caverns are developed by controlled solutioning of salt with water. Also, underground salt deposits are prime candidates for the development of waste disposal facilities. Kansas salt is being studied as a possible national site for the disposal of radio-active wastes.

Future drilling in Arizona will, either by design or accident, likely encounter additional evaporitic materials. Whether the more exotic types exist remains to be determined.

PEIRCE, H.W. (1972), THICK ARIZONA SALT MASSES-AUTOCHTHONOUS? (abs): Arizona Academy of Science, 16th Annual Meeting, Prescott, Arizona P.46/

NEW GEOLOGIC MAPS OF ARIZONA



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KEY TO MAP

1. 1973. R.T. Moore; Geology of the Virgin and Beaverdam Mountains, Arizona: Arizona Bureau of Mines Bulletin 186, 65 p., 24 plates, 7 figures.
2. 1972. C.A. Anderson and P.M. Blacet; Geologic Map of the Mount Union Quadrangle, Yavapai County, Arizona: U.S.G.S. Map GQ-997, scale 1:62,500.
3. 1972. G.P. Eaton, D.L. Peterson, and H.H. Schumann; Geophysical, Geohydrological, and Geochemical Reconnaissance of the Luke Salt Body, Central Arizona: U.S.G.S. Professional Paper 753, 28 p.
4. 1972. J.H. Stewart, F.G. Poole, R.F. Wilson, and others; Stratigraphy and Origin of the Chinle Formation and Related Upper Triassic Strata in the Colorado Plateau Region: U.S.G.S. Professional Paper 690, 336 p., 5 plates.
5. 1972. R.L. Laney; Chemical Quality of the Water in the Tucson Basin, Arizona: U.S.G.S. Water-Supply Paper 1939-D, 46 p., 5 plates.
6. 1972. C.A. Anderson; Precambrian Rocks in the Cordes Area, Yavapai County, Arizona: U.S.G.S. Bulletin 1345, 36 p., 2 plates.

7.a-b 1973. R.H. Roeske and W.L. Werrell; Hydrologic Conditions in the San Pedro River Valley, Arizona, 1971. Prepared by the U.S. Geological Survey in Cooperation with the Arizona Water Commission as "Arizona Water Commission Bulletin 4" 76 p. and 2 plates.

8. 1972. C.A. Anderson and P.M. Blacet; Geologic Map of the Mayer Quadrangle, Yavapai County, Arizona: U.S.G.S. Map GQ-996, scale 1:62,500.