The Great Polarized Light Microscope and the Great Salt Lake

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Teaching on-site courses for the McCrone Research Institute has enabled me to see a lot of the USA. The van and I have been to all of the states except Hawaii and Alaska besides all of the Canadian provinces except Newfoundland and the Northwest Territories. Some parts of the USA have become nearly as familiar to me (and van) as the Outer Drive in Chicago, Rte. 1 down the California coast, Rtes. 80 and 90 to New York and New England, 55 and 65 South, 40 Southeast to Los Angeles and 80 to Salt Lake City and San Francisco, in particular. The latter route across the Great Salt Lake Desert is one of my favorites. That route is always different because of the Great Salt Lake. It's a large lake under normal conditions but conditions are never normal.

Great Salt Lake is the largest brine lake in the Western hemisphere. Today, only the remnant of a much larger Pleistocene Epoch Lake, it is 25% salt (NaCl) just under the saturation level. There aren't many living things able to stomach that concentration, some algae, a few flagellates, protozoa and invertebrates, a brine shrimp, two flys and an occasional floating human. It is a major supplier of salt, thousands of tons so far with no sign of lowering the concentration of the remaining brine.

During the past 10 years, its area has varied from less than 2000 miles^2 to more than 6000 miles^2. About 3 years ago, it was actually lapping at both sides of the roadway and in many places you drove at least partly through a few inches of salt water. On one trip during 1956, they had built a 4-foot levee along the road and I drove dry but below sea-level by maybe a foot. On the last trip in September the lake had receded many miles, leaving a white snow-like crust of salt a few millimeters thick as far as you could see on either side of the road.

I couldn't resist adding to our sand sample collection, so I stopped and chipped out a few chunks of sand with the sand grains cemented together by the salt deposit.

On returning to Chicago, I took a stereo picture of the salt surface (Figure 1), then chipped off a bit of the salt deposit and recrystallized it from a drop of water (Figure 2). On evaporation to complete dryness there were no indications of any anisotropic crystals, hence the salt is very pure NaCl. Sodium sulfate is reported to be a constituent but, if present, I should have seen it since it is less soluble than NaCl and anisotropic (i.e., visible between crossed polars whereas NaCl is invisible). The salt deposit, crushed to small particle size, shows well-cleaved NaCl cubes (Figure 3).

Next, I leached a bit of the underlying sand with lots of H_2O and examined the sand (Figure 4). It is quartz (surprise) and lots of calcite. The latter are aggregates of mostly small particles. They show high birefringence and all very nearly disappear in Aroclor 5442 (n_D=1.662) during rotation of the stage while observing the field with one polar. The clear particles in Figure 4 are quartz; the dark ones, calcite.

There were a few mineral grains showing indices higher than Arolor and these included hornblende, tourmaline, biotite, and an amphibole (kataphonte), others with indices lower than Aroclor included apatite, actinolite and muscovite. All of these minerals were much finer than the sand grains and present only as traces; altogether quite a bit less than one percent of the sand. I assume larger quantities of the heavy minerals have been washed deeper into the sand layer. I did try a one-drop density separation (Figure 5) using bromoform but got only one photogenic tourmaline crystal for my trouble. Figure 6 shows the same crystal at higher magnification after picking it out of the bromoform, drying and remounting in Aroclor to make sure its refractive indices were slightly less than 1.66, and therefore tourmaline. It is too thin, about 5 μm, to show significant pleochroism. At this point, fortunately, for you, I felt I knew as much as I wished to know about the Great Salt Lake.

The van and I have collected a lot of other samples so if our Editor, Thom Hopen, rattles my cage again I"m ready to dig out another one that might interest some of you (besides me). ■

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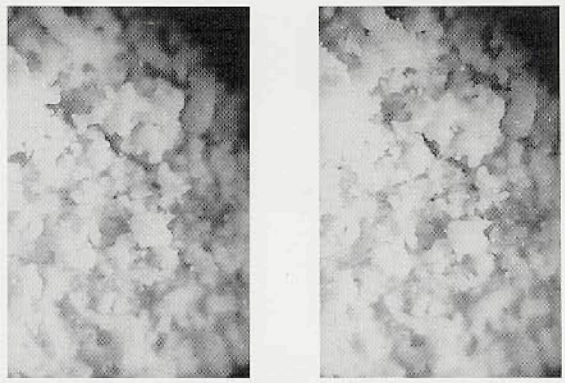

Figure 1. Stereo photomicrograph of the salt residue surface of the dry Great Salt Lake bed. 20X.

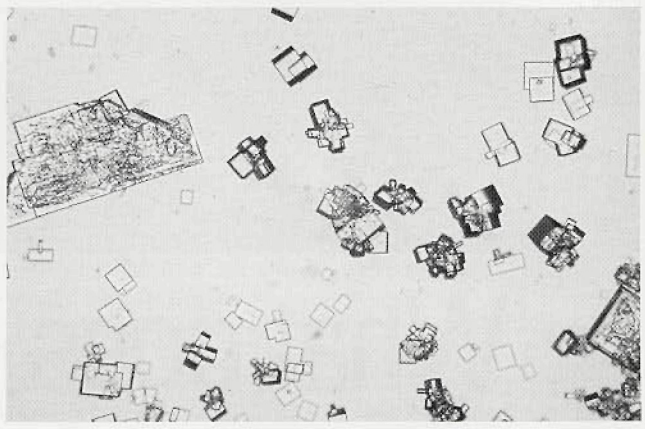

Figure 2. Cubes of sodium chloride crystallizing in an aquous drop of salt solution from Great Salt Lake. 100X.

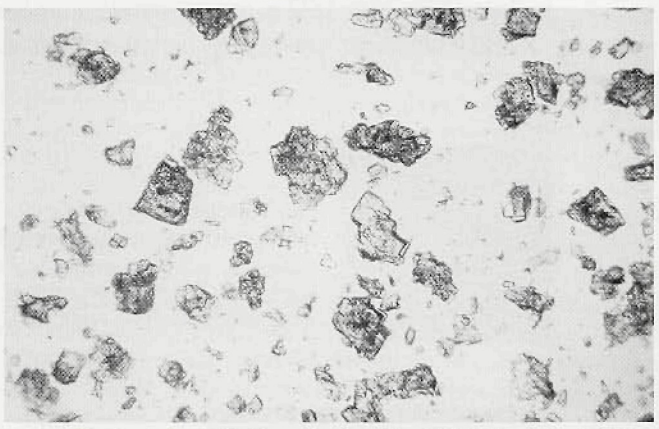

Figure 3. Crushed salt (NaCl) residue from Great Salt Lake dry-bed. 100X.

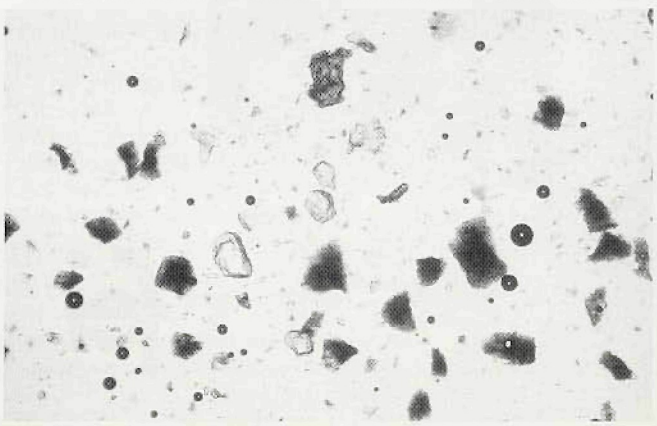

Figure 4. Sand sample for Great Salt Lake underlying deposited salt layer.

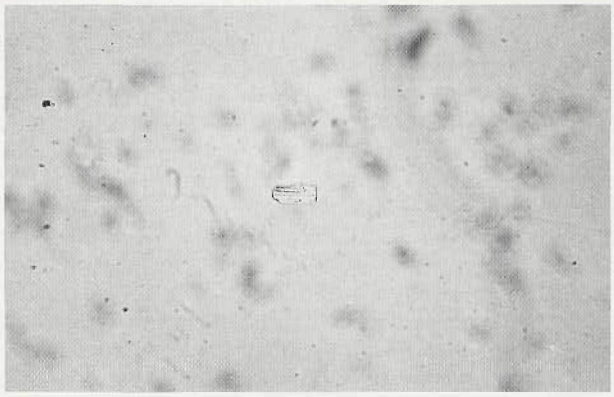

Figure 5. A crystal of tourmaline from Great Salt Lake sand lying on the bottom of a drop of bromoform (density about 2.9). Lighter minerals floating on the same drop are out of focus. 100X.

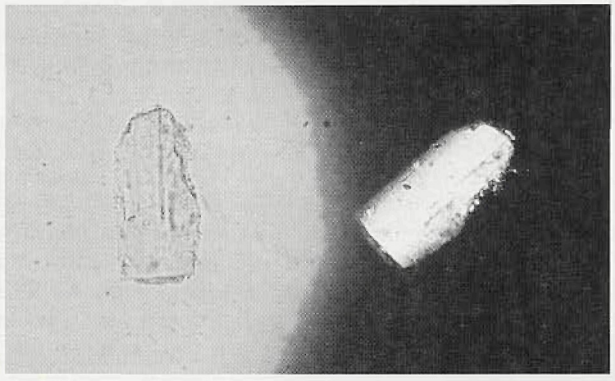

Figure 6. The same tourmaline crystal remounted in Aroclor shown (left) with ordinary transmitted light and (right) with crossed polars. 400X