edges while viewed under the same conditions as in observing the ilmenite fragments. Likewise picotite appeared a light tan color on thin edges.

The explanation of this phenomenon in an opaque mineral is not known to the writer, but the observations, and the conditions under which they were made, are recorded here in the hope that they will be of use to students working with opaque detrital grains. These would probably need to be crushed to obtain angular fragments. The author will be glad to learn whether others obtain the same result with crushed grains of ilmenite.

HOPPER CRYSTALS OF HALITE IN THE SALINA OF MICHIGAN

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In the manufacture of grainer salt, crystal growth is effected by evaporation at temperatures below boiling in order to prevent turbulence and permit the formation of a thin surface film of high density brine. In this film the halite crystals begin to grow. As growth continues the cube tends to sink under its own weight although it is held at the surface by surface tension. Because only one cube face of the crystal is in contact with the high density film, growth takes place only along its edges. In this manner, while the crystal sinks, growth continues upward and outward along these edges resulting in a hollow pyramid with its apex pointing downward. When the surface is disturbed the crystals are broken or swamped and sink. Manufactured crystals of this sort are shown in Figure 1.

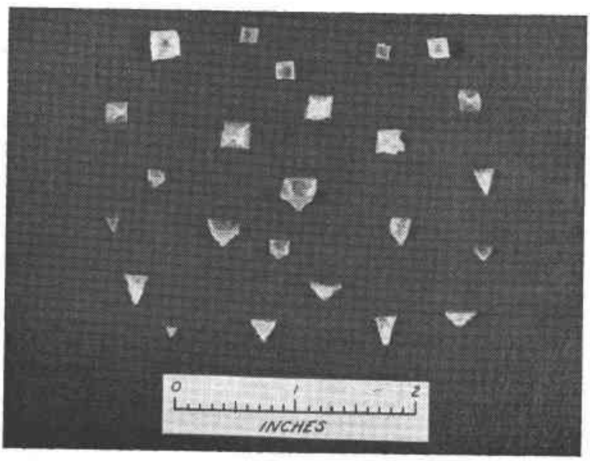

Fig. 1. Artificial hopper crystals.

Fig. 2. Photomicrograph of hopper crystals outlined by oriented liquid inclusions. (×18)

Growth of salt crystals at the surface of present day saline lakes and basins is not uncommon and the hopper crystals have been reported by Eardley (1938) in the salt mush along the margins of Great Salt Lake.

This same type of crystal has been observed in the Salina salt near the base of the core of the G. Bradley No. 4 well in Newaygo County, Michigan. The crystals shown come from a depth of approximately 4900 feet. In general the thick salt beds occur as alternating layers of clear, coarsely crystalline salt and cloudy, finely crystalline salt. These layers may be interrupted or separated by tissue thin layers of anhydrite and/or dolomite. Petrographic examination has shown that the cloudy appearance of alternate layers is due to an abundance of brine inclusions in the form of negative crystals. These inclusions have a linear orientation and the intersection of two series of parallel lines produces a chevron structure. Chance orientation of several crystals has facilitated the identification of the hopper structure (Fig. 2). The darkened zones are caused by the inclusion banding. It is interesting to note that the artificial hopper crystals, as well as the natural ones, contain an abundance of negative crystals and there is at least a suggestion that these inclusions are in part a function of surface growth.

References

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