SALT INTRUSION IN NORTHEASTERN OHIO*

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Salt intrusion has been recognized and described in many different areas of the world (Nettleton, 1934). However, it has not been described before from northeastern Ohio except for a brief mention by the author at The Ohio Academy of Science meetings in 1954. This paper is concerned not with the mechanics of this intrusion but with the evidence of intrusion.

Both the Diamond Alkali Company and the Morton Salt Company have drilled a number of deep wells in the Painesville area. One of Diamond's exploratory wells, locally called the Concord Well, drilled in 1953, is located about 7 miles south of their main plant at Fairport Harbor, Ohio (fig. 1). The well (surface elevation—882 ft above mean sea level) was drilled to a depth of 3,104 ft and bottomed in dolomite of Silurian age. A second well, one of several drilled by Morton Salt, is located near their present mine shaft at Fairport Harbor. This well (surface elevation—602 ft above msl) was initiated in the Chagrin shale, penetrated the salt sequence, and bottomed in dolomite of Silurian age. The first massive salt bed was encountered at a depth of 2,355 ft (1,473 ft below msl) in the Concord Well, and at 1,920 ft (1,318 ft below msl) in the Morton Well. This difference in the elevation of the top of the first massive salt (155 ft) can be accounted for by the regional dip which is about 25 ft per mile toward the southeast (Pepper, 1947). The Concord Well is approximately 6 miles down dip from the Morton Well.

There are three main salt units in the Painesville area, each consisting of from two to seven individual salt beds. The upper unit has an aggregate thickness of 100 ft. The aggregate thickness of the middle unit is about 35 ft whereas the lower unit is about 110 ft thick (fig. 2). Lithologic correlation between the Diamond and the Morton cores is excellent. Moreover, the upper salt unit of this area is apparently the same age as the "F Salt-Number One" bed of the Michigan region as shown by gamma ray log information (oral communication, John R. Ulteig, Skelly Oil Company).

Megascopically, the salt shows a layered structure, but it also occurs as individual crystals which range from 1/16 to 2 in. in diameter, and as crystal aggregates which measure from 1/2 to 3 in. in diameter. The remainder of one anhedral

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crystal partly destroyed by drilling, is about 2 in. in diameter. Most of the salt is clear or white to gray; however, light pink to red salt is also present.

Evidence of salt intrusion is observed throughout the salt section in cores from the two wells. Two small plugs and numerous dikes and stringers are recorded. In most cases the intruded salt cannot be traced back to a source bed; and furthermore, the intrusive is commonly below the nearest thick salt bed. However, much of the intruded salt is in shale within a massive salt bed.

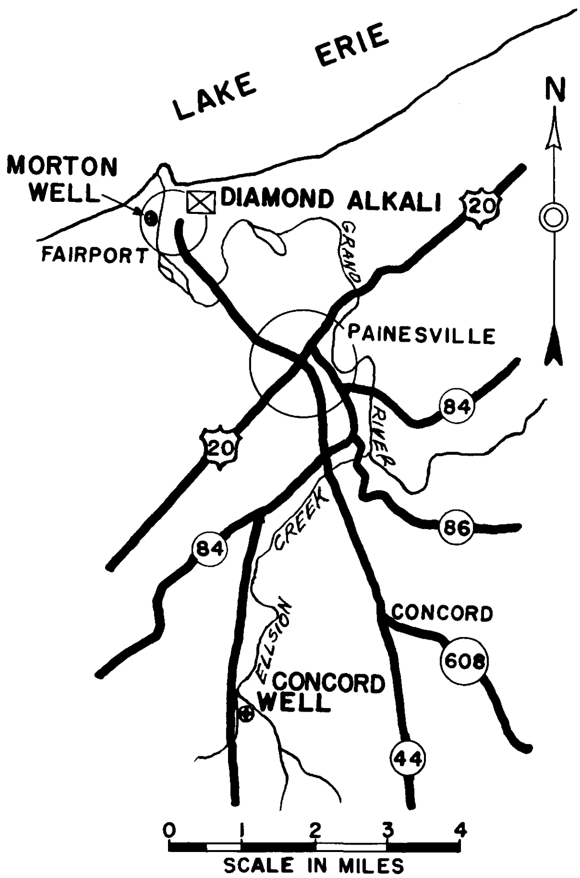

FIGURE 1. Map showing general location of the two drill sites mentioned in this paper.

The clear and white, translucent intruded salt is usually associated with dolomite and anhydrite, whereas the red salt, colored by hematite, is found associated with greenish-gray shale. Elongated anhedral salt crystals are orientated perpendicular to the direction of the intrusion and the texture of the intruded salt looks very much like that of a coarse-grained gneiss. This feature is characteristic of the intruded salt plugs of the Gulf Coast (Balk, 1947). The grains average ½ to 1 in. in length and ¼ in. in diameter. Fragments of brecciated wall rock are included in the salt. The dikes and stringers range from about $\frac{1}{16}$ to 1 in. in thickness (fig. 3). A 1¾-in. circular plug of coarse-textured crystalline salt was circumscribed by the core bit and is incorporated in the core. Most slickensides show rotational patterns and are not typical of those produced by compaction.

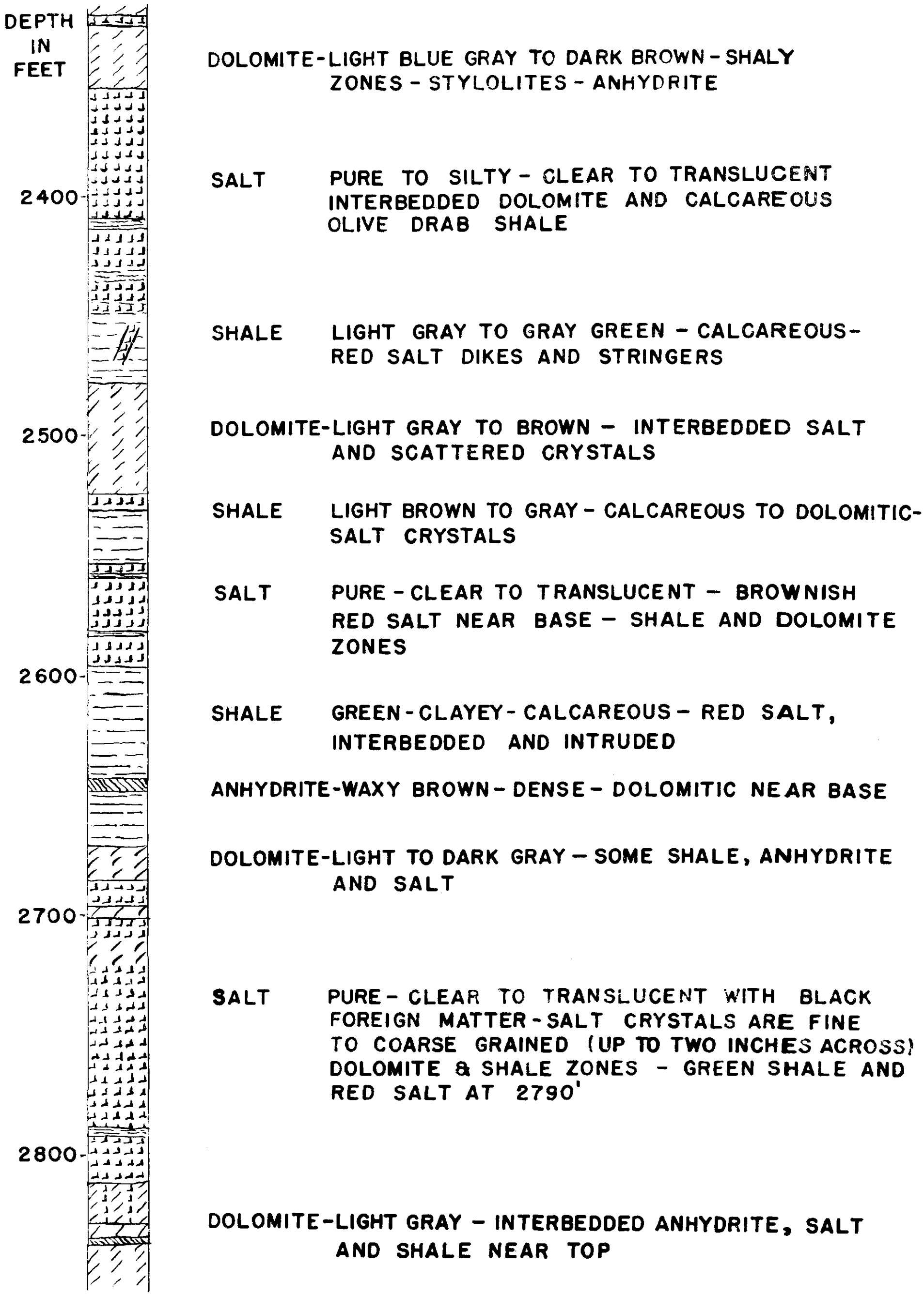

FIGURE 2. Stratigraphic section of salt beds in the Concord Well. Depth refers to the number of feet below the top of the well casing—882 ft above sea level.

Slickensides, breccia, and rock fragments are associated with all the salt intrusives, although a number of brecciated zones present do not seem to have any direct relationship to the salt.

A number of "stringers" which pinch out at the top and bottom are present. Whether these are intrusions or simply represent the squeezing of saline solutions into fractures and mud cracks with subsequent crystallization is debatable. Commonly anhydrite masses are encountered at either end of the stringer.

One feature which may or may not indicate recrystallization, is the presence of phantom or hopper salt crystals in some dolomitic shale beds (fig. 4). These are found in the Morton core, below the lowest salt bed.

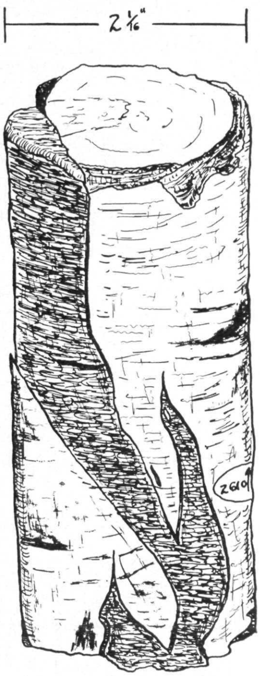

Figure 3

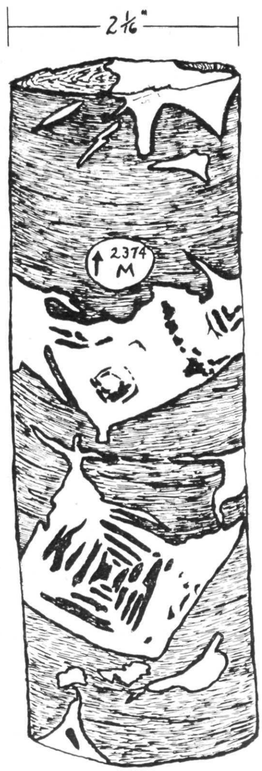

Figure 4

FIGURE 3. Dike of red salt intruded into dolomite and recovered from the Concord core at a depth of 2610 ft. Salt grains are orientated perpendicularly to the wall rock. Salt was partially dissolved during drilling.

FIGURE. 4. Phamtom or hopper salt crystals recovered from the Morton core at a depth of 2374 ft.

One-half mile north of the Concord Well, on Ellison Creek, a number of small open folds with almost horizontal axes are exposed. In some cases these folds are faulted parallel to the axial plane. It seems quite possible that some of this local folding might be explained by more extensive salt intrusion not yet detected by drilling. Another fold axis exists in Stebbens Gulch, about four miles south of the Concord Well. Further, additional folding of individual salt beds can be observed in the Morton Salt Mine at Fairport Harbor.

The majority of the subsurface brecciated zones are associated with salt that appears to be intrusive in nature. On the basis of the present evidence, however, it is difficult, if not impossible, to determine if salt intrusion produced these brecciated zones or was controlled by such zones of weakness.

In conclusion, salt does appear to have been mobilized in the northeastern Ohio region as evidenced by the following subsurface evidence:

1. Circular plugs of salt.
2. Brecciated zones in shale and dolomite.
3. Dikes and stringers of salt.
4. Wall rock fragments in salt.

Although these features might be explained by processes other than salt intrusion, their association in this area suggests the possibility of salt mobilization. It seems probable that additional evidence of this sort may be found by re-examination of the other old drill cores which were originally studied without consideration of this phenomenon.

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