HALITE

NaCl

Halite (rock salt) is one of the most common and widespread evaporite minerals and occurs chiefly in marine deposits. Michigan was the leading salt-producing state in the United States for many years. The thick salt beds were deposited during the Silurian and Devonian periods. The Silurian salt beds are by far the larger, underlying most of the Southern Peninsula. These beds are known as the Salina Group, and measure nearly 900 meters in thickness, over 600 of which is rock salt. The rock salt occurs in six major beds interlayered with dolomite, shale, and anhydrite (or gypsum). The two deepest beds are each over 150 meters in maximum thickness. It has been estimated that the Salina Group in Michigan contains about 25,000 cubic kilometers of rock salt (Briggs, 1960).

The younger Lucas Formation, of Devonian age (Detroit River Group), is restricted to the northern part of the Southern Peninsula. The total thickness of Lucas salt is over 120 meters in a maximum of eight beds, the thickest of which may exceed 30 meters (Briggs, 1960). Salt also is obtained from natural and artificial brines. Natural super-saline brines fill pores in the permeable Parma, Marshall, Berea, and Dundee formations. Economically, the most significant are the Marshall brines. In the 1880s, over one hundred natural brine evaporation plants were in existence. By 1975, only about a dozen operations were left. Of these, the largest was at Midland, where natural and artificial brines from several sources produced bromine, calcium chloride, and other chemical products as well as salt.

Figure 88: A 9 cm cleavage of halite from the Detroit Salt mine, Detroit, Wayne County. A. E. Seaman Mineral Museum specimen No. DM 23130, Jeffrey Scovil photograph.

Because of the widespread occurrence of halite in Michigan, most of which is subsurface, only a few unusual or representative localities are listed. Southern and Northern Peninsulas.

Figure 89: These unusual growths of halite crystals were collected from a small post-mining pool of brine in an inactive area of the Detroit Salt mine, Detroit, Wayne County. 2.5 x 3.5 cm area. A. E. Seaman Mineral Museum specimen No. DM 23131, Jeffrey Scovil photograph.

Alpena County: Alpena: Considerable salt thickness encountered in drilling (Smith, 1915a).

Bay County: Bay City: Formerly produced salt in large amounts by evaporation of natural brines pumped from the upper Marshall Sandstone from about 300 meters.

Houghton County: Quincy copper mine, 85th level: Occurs as a post-mine mineral in stalactites, stalagmites, encrustations, 2.5 cm cubes, and fine threads. Slabs up to 30 cm square and 5 cm thick were found as well as crystals in pools. Most crystals are cubic, some cubo-octahedral, and some contain microscopic inclusions of copper (T. M. Bee, personal communication, 2000). Chemical analyses show this halite is essentially pure (Spiroff, 1937a, b).

Isabella County: Mount Pleasant: Halite, bromine, and calcium chloride were produced from natural brines from the Marshall Sandstone.

Manistee County: **1.** Manistee. **2.** Filer City. **3.** East Lake: Halite formerly produced by evaporation of artificial brines (Smith, 1915a). One salt bed with a thickness of 6 to 9 meters underlies Manistee.

Mason County: Ludington: Formerly from artificial brines (Smith, 1915a). Four salt beds, from 1.5 to 6 meters thick, have been penetrated.

Midland County: Midland: Halite and bromine formerly produced from natural brines from the Marshall Sandstone.

Newaygo County: Sun Oil Company Number 4 Glen Bradley well, section 11, T12N, R13W, at 4,900 feet: Hopper structure in halite revealed by orientation of brine inclusions in negative crystals (Dellwig, 1953, 1955). The cores show two types of halite occurrence: 1) Even-bedded salt with halite layers 3 to 8 cm thick alternating with tissue-thin laminae of anhydrite and dolomite. Individual halite grains are less than 1 cm across. 2) Coarse, irregularly bedded halite with grains averaging several centimeters across. Accessory species are pyrite, carnallite, gypsum, quartz, and polyhalite (Dellwig, 1955).

Presque Isle County: **1.** Onaway: A test well for oil penetrated more than 243 meters of rock salt over an interval of 365 meters. The lowest bed was 68 meters thick. **2.** Grand Lake: Over 90 meters of salt penetrated without reaching the bottom of the Salina Group (1, 2, Smith, 1915a).

Saginaw County: Saginaw: Formerly, abundant natural brines from Upper Marshall Sandstone from a depth of about 180 meters were evaporated. Calcium chloride also was obtained.

St. Clair County: **1.** Port Huron. **2.** St. Clair. **3.** Marine City: Salt has been produced by evaporation of artificial brines obtained by forcing water through injection wells to rock salt beds of the Salina Group and returning the saturated solutions to the surface (Smith, 1915a). **4.** Approximately 6.5 kilometers north of Anchor Bay, sections 22 and 27, T4N, R15E: Rock salt with associated dolomite, anhydrite, and gypsum in a core penetrating the Salina Group on the flanks of the Peters reef (Sharma, 1966).

Wayne County: *Detroit Salt* Company (former International Salt Company) mine at Detroit: The first attempt to sink a shaft for mining salt in the Detroit area was begun in 1902 in a swamp bordering the Detroit River, south of the Ecorse River. It was unsuccessful. The shaft collapsed at 24 meters. In 1904, the Oakwood shaft was begun. The mine began producing salt in 1910, and this has been Michigan's only salt mine. The section at this locality contains an aggregate thickness of more than 136 meters of rock salt with mining operations at 317 meters in a 7.5 meter bed which lies near the top of a much thicker salt bed (Landes, 1960a, b). The thick-bedded salt characteristically occurs in light colored bands, 5 to 20 centimeters thick, separated by thin darker seams (varve structure). The dark bands consist either of a single layer of white or gray anhydrite or of several paper-thin anhydrite layers, separated by intervening, narrow, variable-thickness salt bands. The anhydrite lamellae may be so closely spaced that 4 or 5 appear within a vertical centimeter. The thicker salt layers between the dark bands also commonly contain these same thin lamellae which are not distinguishable megascopically because they lack the dark color (Kaufman and Slawson, 1950). At least nine layers of salt in a 5 meter section show ripple marks (Kaufman and Slawson, 1950). Another distinctive and common feature is agglomerations of recrystallized salt which are the source of large cubical halite specimens prized as souvenirs and for mineral collections. Single crystals half a meter or more across are known (Slawson, 1937). The agglomerations, which transect the bedding, range in size from barely observable blebs to masses

extending from floor to roof and laterally for a considerable distance (Landes, 1960a, b). Some agglomerations are characterized by collapse features at their tops and concentrations of insoluble impurities toward their bottoms (Landes, 1960a, b). Accessory minerals of the salt beds are quartz, anhydrite, pyrite, carbonaceous material, celestite, dolomite, and hematite (Briggs, 1960). Fine specimens of post-mining halite crystals are also found in pools in older areas of the mine.

International Salt Company stopped production at its Detroit mine on January 14, 1983, and, in early 1985, sold it to Crystal Mines, Inc. After the shutdown, tourist visits to the mine were offered from January through March, 1983, when 21,000 visitors viewed the mine. Two years later, plans were in place to convert the mine to a toxic waste disposal dump, and public tours ceased on April 26, 1986. At that time, it was estimated that about 45 million metric tons of salt were produced from the mine over a period of 73 years.

After a decade of dormancy, the Detroit Salt Company was formed in 1997, and within nine months of rehabilitation, the historic Detroit salt mine was once again producing rock salt. The current production is used primarily for ice control and various chemical applications. Presently, the Detroit Salt mine is the last commercially producing underground mine in Michigan (E. Z. Manos, personal communication, 2000).

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