TREMOLITE DEPOSITS OF THE MINERAL RANGE, MILLARD COUNTY, UTAH

by

Arthur L. Crawford
Alfred M. Buranek

Circular No. 2

Prepared and Released under the Sponsorship of

THE STATE OF UTAH

RAW MATERIALS DIVISION

DEPARTMENT OF PUBLICITY & INDUSTRIAL DEVELOPMENT

Atlas Building

Salt Lake City, Utah

September 1942

TREMOLITE DEPOSITS OF THE MINERAL RANGE, MILLARD COUNTY, UTAH

A Preliminary Report

By: Arthur L. Crawford 1/
Alfred M. Buranek 2/

ABSTRACT

A large deposit estimated to contain over 16,000,000 tons of crude tremolite of possible low grade asbestos quality is described. The occurrence is in the Mineral Range of mountains in southern Millard County, Utah, just north of the Beaver County line. The general geology is considered and the appearance of the tremolite and its microscopic properties, chemical composition, origin, extent, ease of mining and possible economic outlets are discussed.

Introduction

Under the authroization of the Utah State Department of Publicity and Industrial Development, Mr. William H. Bishop, a Mr. Clardige, and the writers visited the Mineral Range, on July 31, 1942. The purpose was to examine the tremolite and potash deposits controlled by these men and their associates.

Location, transportation, etc.

The occurrence is just north of the Beaver County line in Millard County, Utah, in the north end of the Antelope mining district of the Mineral Range of Mountains. Approximately ten miles west is Black Rock, a station on the Union Pacific Railroad. Although some tremolite occurs on the east side of the range, the main deposits are located on the south slope of one of the west spurs near the north end of the range and in the ravine and adjacent low ridge to the south of this spur. They are covered by six unpatented claims. The property is accessible over a good dirt road

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1/ Geologist and Mineral Technologist, Utah Engineering Experiment Station, University of Utah
2/ Geologist, Utah State Department of Publicity and Industrial Development.

that connects Black Rock and Highway 91 at a point a few miles north of Cove Fort, Utah.

As the climate of the region is definitely arid, no water for either culinary or mining purposes is available at or immediately near the holdings. The nearest supply of water is Antelope Springs, several miles to the west of the claims, and unless artesian water can be developed at the foot of the range it would have to be hauled or pumped from these springs to supply culinary and mining needs.

Geology

The geology of the northern part of the Mineral Range, is complex. The sedimentary formations have been disturbed by both low-angle thrust faults and north-south trending normal (Basin Range) faults, and have been metamorphosed in the area of the tremolite deposits by a granitic intrusive. Judging from the lithologic character of the rocks exposed near the tremolite deposits the writers feel quite safe in assigning the quartzites to the Tintic (or Prospect Mountain) quartzite of basal or lower Cambrian age and the limestones to the lower Paleozoic of probable Cambrian and Ordovician age. The Quartzites are fine grained, compact, massive, pink and gray. The limestones are massive bedded, blue to gray, siliceous near the top, and dolomitic in part.

The exposed portion of the quartzite is estimated to have a thickness of 1,000 feet, and from the superficial examination of the writers, the formation appeared comparatively uniform throughout. Much of the limestone is also quite uniform, some of it showing the thin-bedded character with mottled impurities characteristic of the Cambrian and Ordovician limestones and dolomites of the Wasatch and Basin Ranges. Other variations in texture noted were associated with the faulting and mineralization and have no direct bearing upon the original nature of the beds. The uppermost strata of the limestone, near the contact with the over-thrust quartzite, were siliceous, containing lenses of chart up to twelve inches in length. The thickness of limestone series was estimated to be well over 1,000 feet and is tentatively placed at approximately 1,500 feet.

Butler [1/] in his detailed description of the San Francisco Range, which is a few miles west and south of the area visited, describes a similar series of quartzites and limestones as being Cambrian, Ordovician, and Silurian in age. Because of fossil evidence he has definitely proven the shale member at the top of the limestone series to be basal Ordovician and has thus tentatively placed the great thickness of underlying limestones as Cambrian. Further, because the quartzite, which he calls the Morehouse quartzite, rests upon the limestone he suggested that it is Ordovician and Silurian in age, representing a normal sequence of deposition, the quartzite being younger than the limestones. If it is assumed that the so-called Morehouse quartzite is in fact the Tintic Quartzite overthrust upon the limestones, then the description given by Butler of the San Francisco region correlates with the sedimentary series exposed in the northern end othe Mineral Range, the only difference being that the section of the San Francisco range includes from Cambrian to Triassic, whereas the area under discussion, so far as the writers were able to ascertain, contains only the lower Paleozoic limestones and quartzites. The superjacent Paleozoic and Mesozoic formations are missing, possibly because erosion has stripped the less resistant beds down to the durable quartzites. Although there is a strong similarity between the limestones and quartzites of the two areas, it is the opinion of the writers that here, at least, the quartzite series can be directly correlated with Tintic or Prospect Mountain quartzites of lower Cambrian age, and that they are not younger than the limestones upon which they rest but in reality are older.

1/ Butler, B.S., Geology and Ore Deposits of the San Francisco and adjacent Districts, Utah: U.S. Geol. Survey. Prof. Paper 80, 1913.

Low-angle thrust faulting was observed at the contact of the limestones and the quartzites, and it appears that compressive forces from the southwest caused the great thickness of quartzites to ride northeastward over the younger limestone series, thus accounting for the unconformable sequence of the beds. This thrusting from the southwest is in harmony with the forces known to have been prominent in other Basin Ranges and is strongly suggested by the prominent low-angle thrust plane striking approximately north-northwest and dipping to the west, which was observed at various points widely separated, some distance to the west of the tremolite deposits. Further, associated with the fault, a brecciated zone five feet or more in thickness was measured at several places. It consists chiefly of angular fragments of quartzite firmly cemented by subsequent silica, calcite, limonite, barite, etc.

Normal faulting was observed in a number of lead-silver-copper prospects to the north of the tremolite, and one fault, at least, was post mineral for the minerlized thrust plane was offset many feet. Here, the Tintic (Prospect Mountain) quartzites appear to have been over-thrust from the west on to Cambrian limestones, and the north and later dropped down by a prominent normal east-west (Lead Canyon) fault so that the resistant Tintic quartzite now forms the northwest (corner) spur of the range. The quartzite spur is separated from the next spur (Barite Ridge) by a canyon erroded out along what appears to have been the plane of the normal fault. Furthermore, there is every reason to believe that the comparatively abrupt western face and straight outline of the range is due primarily to a Basin-Range fault or series of faults later in age than the thrusting, intrusion, and consequent mineralization.

The granitic intrusive exposed to the south of the area visited has formed the tremolite bodies and was no doubt responsible for most other mineralization in the region. Proof of the igneous activity in the immediate area was evidenced by the existence of the large body of termolite and sections of compact, crystalline, marbelized limestone indicating that the intrusive at this point is immediately beneath the surface but has not yet been unroofed.

Tremolite Deposits

The tremolite deposits are unusually extensive and have been formed by contact metamorphism of siliceous dolomites through the agency of the granitic intrusion prominently exposed a few miles to the south. The chief tremolite body is estimated to be roughly 1500 feet in length, 1200 feet in width, and at least 100 feet in thickness. Such a body is equivalent to approximately 16,200,000 tons of useful tremolite.

The color of the tremolite varies from dark gray to white and is rather uniform throughout. The zones, above and around the intrusive, progressively contain less and less tremolite until it is completely absent.

Petrographic Description

The dark color of certain sections of the tremolite body is due to unassimilated carbon, which under the microscope is frequently present in concentric liesegang rings about the nuclear points from which radiate the tremolite fibers.

A typical specimen of the tremolite rock consists of from 50 percent to 100 percent tremolite crystals forming stellated-radiating patterns intergrown with more or less calcite as the chief impurity. Their thickness varies up to one-half millimeter. However, a preliminary microscopic study by Crawford of thin sections of this material showed that most of these larger crystals are in reality bundles of intergrown microlites having the full length of the apparent crystal but only a fraction of its thickness. These individual microlites are seldom over 0.01 mm. across but have an average length of 10 to 15 millimeters. Hence, their length averages approximately 1000 times their thickness and, therefore, even though these microlites are comparatively brittle, their fibrous nature and partial flexibility gives them the properties of a low-grade asbestos.

Tremolite has the general formula Ca $(Mg.Fe.)_3$ $(SiO_3)_4$, but this variety seems to contain little iron and for all practical purposes may be regarded as Ca SiO_3. 3Mg SiO_3. In other words, during the metamorphism of the dolomite CO_2 has been replaced by SiO_2 and magnesium has either been added from the igneous eminations or lime has been carried away by these solutions, possibly both, since the ratio of calcium to magnesium in dolomite is 1:1 while in tremolite it is only 1:3.

Because of the crystalline structure of the tremolite, the rock mass is extremely tough and hard to break, The term "mass fiber" tremolite is appropriate for this material, since in no case (except in border facies where single tremolite crystals were disseminated in massive limestone) was any form of tremolite observed other than the type described above.

Economic Possibilities

The rock is a mass-fiber tremolite asbestos of relatively high purity. The deposits are large, extensive and easily mineable. The cheapest and most economical type of mining can be employed. The chief deposit forms a dip slope beginning at the base of the mountain and extending upward at about 15° over 1000 feet. There is no overburden. Transportation facilities are good as the property is accessible over a fair dirt road which encounters no grades of importance. A railroad spur 10 miles long would connect the deposit with the main line of the Union Pacific Railroad. Hence, if a market could be found sufficiently large to justify building this spur, the material could be extracted at an extermely low cost.

Asbestos is one of the few mineral products which the United States must now import[1/] in large amounts. Naturally, Chrysotile, the long, spinning

1/ See "Asbestos" in "Strategic Minerals of Utah" Utah Engineering Experiment Station Bull. 18, p 13, by Arthur L. Crawford.

fiber is in much higher demand, nevertheless, the market for tremolite asbestos has not been fully exploited. Because of its high acid resistance, tremolite is particularly useful in making filter pads for fruit juices and for other industrial applications where acid resistivity is at a premium. Its use as a reinforcing constituent in cements, refractories, etc., offer greater possibilities for large tonnage consumption. If this material can be utilized by industry, perhaps as coatings for steam pipes, fire-proof roofing, asbestos-cement shingles, asbestos-cement plaster, etc., it appears that the tremolite deposits discussed in this report are of economic significance and worthy of further and detailed investigation.

Occurrence of Water Soluble Potash

An occurrence of low-grade water soluble potash is located near the western margin of the tremolite body and is readily noticeable by the snow-white color of the outcrop of decomposed marble in which it occurs. A relatively small area contains the potash and has been prospected by a short tunnel. It has no particular economic significance. Although the origin of the potash is not completely clear, its association with what appears to be a thrust plane between the tremolite and marbleized limestones immediately adjacent, suggests that a relationship exists between the igneous intrusive and the potash. However, supergene artesian waters may have carried chlorides and sulfates of potassium along the fault plane so that they became relatively concentrated by evaporation near the outcrop. The grade and quantity is not sufficient to justify exploitation. Therefore, no attempt was made to ascertain by microscopic study the mineral in which the potash occurs.