

Corrensite in the Wellington Formation, Lyons, Kansas

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Abstract

Corrensite, a regularly-interstratified mixed-layer chlorite-vermiculite, has been detected in four samples taken from just below the Hutchinson Salt Member of the Wellington Formation at depths ranging from a few meters (less than ten feet) to about 30 meters (about 100 feet) below the base of the salt. The corrensite is intermixed with illite and chlorite as well as non-clay minerals such as gypsum, anhydrite, halite, quartz, and dolomite. This represents a new occurrence of corrensite in association with an evaporite sequence and reinforces the view that corrensite is formed in (hyper-) saline environments.

Introduction

Corrensite, a regularly-interstratified mixed-layer chlorite-vermiculite, was first identified in southern Germany by Lippmann (1954) who later identified this mineral in the Röt Member of the Triassic near Göttingen, Germany (Lippmann, 1956). Bradley and Weaver (1956) describe a similar chlorite-vermiculite mineral from the Brazer Limestone (Upper Mississippian) of Colorado, and suggest that occurrences of corrensite are not rare. Many of the known occurrences of corrensite appear to be in known evaporite sequences or in horizons which contain gypsum, dolomite, *etc.* Fourier (1961) reports corrensite in the evaporites of the Salado Formation in New Mexico. Grim, Droste, and Bradley (1960) also report corrensite-type mixed-layer clay minerals in the Permian evaporites in New Mexico. However, the present authors are not aware of any reports of corrensite from the Permian evaporites of central Kansas.

Samples

All the corrensite-bearing samples came from a core taken by the U. S. Atomic Energy Commission at the old Carey salt mine in Lyons, Kansas. More than 70 samples were X-rayed during a study (Kopp and Fallis, 1973) designed to determine the mineralogy and potential for de-watering of the evaporite sequence prior to utilizing the site for a demonstration radioactive waste repository. All the samples which contain corrensite came from drill core AEC-1 at the Carey site and were located at depths of 330.9 m (1085.5'), 341.4 m (1120.0'), 344.5 m (1130.4') and 361.3 m (1185.5') relative to the elevation of the coring site.

These depths lie between the base of the Hutchinson Salt and the underlying anhydrites of the Wellington Formation.

Experimental

The samples were ground to pass a 325 mesh sieve and then elutriated onto glass slides using deionized water. Although no preliminary size fractionation was undertaken, this procedure tends to concentrate the finer, clay-sized fraction on the upper surface of the slide. Two slides were prepared from each sample. Both slides were X-rayed and compared for uniformity of resultant X-ray pattern and hence mineral content. One slide of each sample pair was saturated with ethylene glycol and X-rayed. The second slide was subjected to a series of heat treatments using a combination of the methods suggested by Warshaw and Roy (1961) and Bradley and Weaver (1956). In this study the samples were X-rayed after each of the following heat treatments: 375°C for 12 hours, 475°C for 12 hours, and 550°C for 2 hours.

Results

The results of the X-ray analyses of untreated, glycolated, and heat-treated samples are summarized in Table 1. Although the background radiation levels precluded the resolution of the large (001) spacing (24Å to 32Å) peaks in these mixtures, the other (00l) peaks are present in a nearly regular series of the fundamental period. The final broad peaks at 12Å (observed for two of the samples after heating to 550°C) fit the description given for corrensite by both Warshaw and Roy (1961) and Bradley and Weaver

TABLE 1. Positions (in Å) of the Observed X-Ray Diffraction Peaks in Corrensite after Various Treatments*

Untreated	Glycolated	375°C 12 hrs	475°C 12 hrs	550°C 2 hrs
--	--	14B**	13.8B	13.6B
13.8B	15.8B	12.6B	12.1B	12.1B
10	10	10	10	10
9B	7.9B	8B	8B	--
7.1	7.1	7.1	--	--

* *Elutriated samples from corrensite-bearing shales at Lyons, Kansas, taken at 341.4 m depth.*

** *In this table, broad peaks are labelled B.*

(1956). Other clay minerals identified by these treatments are chlorite and a 10Å mineral (illite or a mica). Gypsum, anhydrite, quartz, and dolomite are also present in these samples.

Discussion

Lippmann (1956) states, "It was first thought by the author that corrensite might be an indicator of saline environment. But the occurrence of Bradley and Weaver's samples refutes this idea." Lippmann concludes that corrensite is caused mainly by "provenance," and that corrensite originates by the "depletion" of chlorite derived from extensive outcrops of chloritic metamorphic rocks.

This newly noted occurrence of corrensite at Lyons, Kansas, in association with a well-developed evaporite sequence suggests that the stability relationships and origin of corrensite need to be restudied. If corrensite is simply a product of mild, long-lasting leaching as suggested by Lippmann (1956), then some explanation must be offered for its general absence from vast quantities of sediments. On the other hand, if it does form in (hyper-) saline environment, both its presence and absence might be explained on the basis of other physical, chemical, or mineralogical parameters. For example, corrensite may not form unless some minimum magnesium ion concentration is reached or below some temperature vs salinity curve. The presence of corrensite in the Brazer Limestone (Bradley and Weaver, 1956) should be further studied. Bradley

and Weaver offer no explanation for its presence, nor do they relate the Brazer Limestone to any chloritic metamorphic rocks. It seems possible that the corrensite found in the Brazer Limestone was derived from pre-existing evaporites rather than metamorphic rocks. Evaporite-mineral-bearing formations, such as the Charles Formation (Middle Mississippian), the Potlach Anhydrite (Upper Devonian), and the Prairie Formation (Middle Devonian) occur over wide areas to the north in Montana and parts of Wyoming (*Geologic Atlas of the Rocky Mountain Region*, 1972), and might contain source beds for the corrensite Bradley and Weaver (1956) identified from the Brazer Limestone in Colorado.

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