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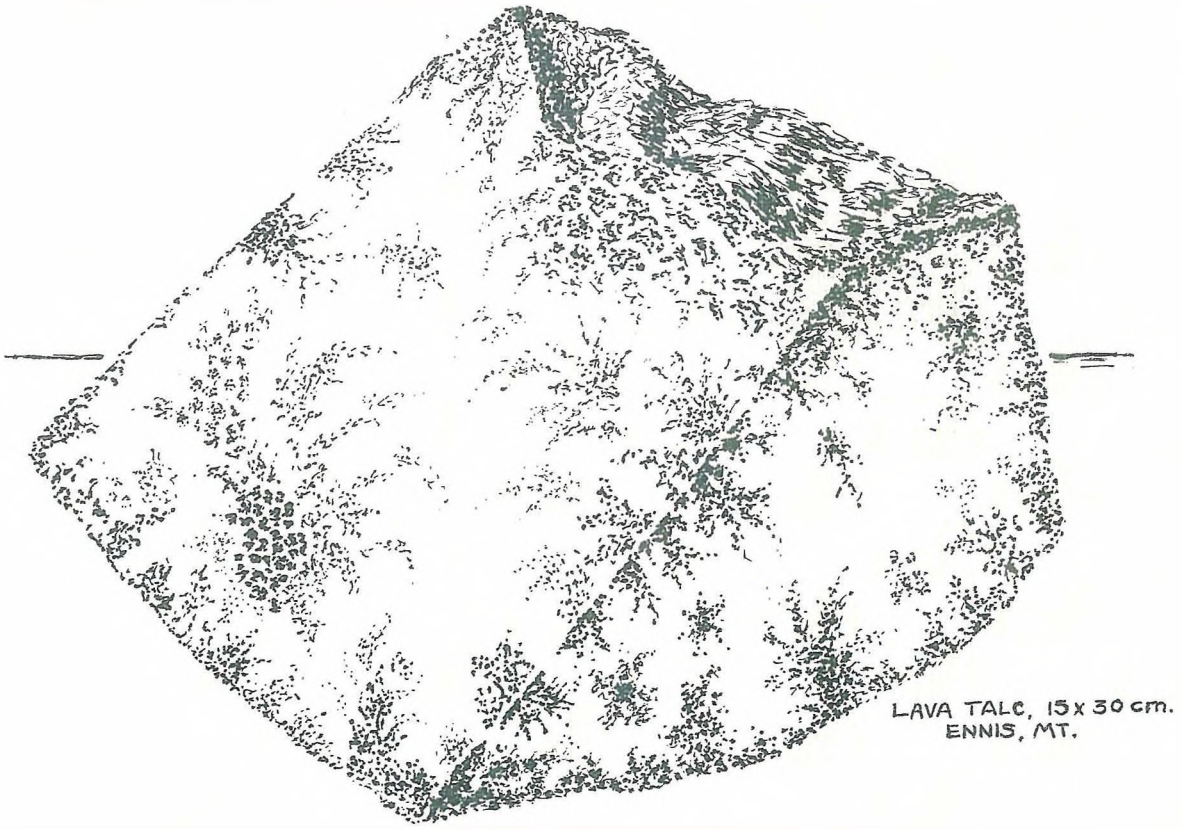
TALC AND CHLORITE DEPOSITS IN MONTANA

by

Richard B. Berg



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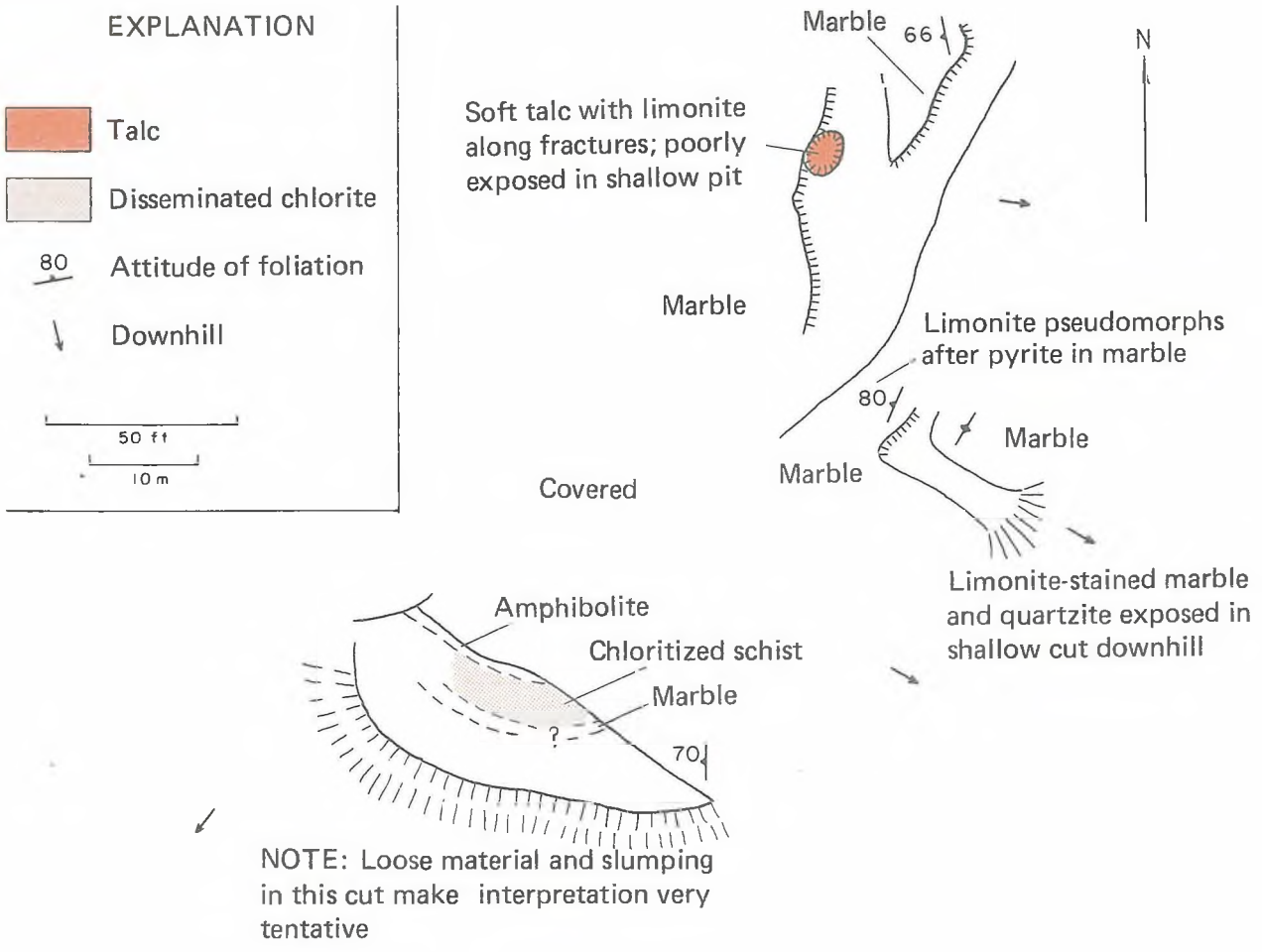

Figure 13—Doubtful claim, Greenhorn Range (R. B. Berg and L. Swanson, June 1976).

Description: Sheared and contorted talcose marble and graphite schist are exposed in the deepest part of the cuts, but pods of pure talc are not exposed. Because of a lack of exposures uphill and to the south of the area shown in **Figure 14**, the areal extent of the body of marble can only be approximately inferred, but the body is not a continuation of the talc-bearing marble at the Willow Creek mine; the two marble bodies are separated by a large area of calcitic marble **(fig. 15)**.

GH-42 Willow Creek mine (Ruby Ridge mine)

Location: NE¼ sec. 30, T. 8 S., R. 3 W., Madison County. Home Park Ranch 7½-minute quadrangle. Approximately 16 miles (26 km) southeast of Alder.

Accessibility: The sorting yard is adjacent to the Willow Creek road, and the haul road to the talc mine goes through the sorting yard.

Ownership: The mine is owned by the Madison Minerals Corporation, Butte, Montana, and is operated by Resource Processors.

Description: Although a small amount of talc was mined underground many years ago, the only significant production has been that by Resource Processors between 1970 and 1979. Mining ceased in June 1979. Talc ore is hauled to the sorting yard and after sorting is trucked to Alder for rail shipment.

The mine is situated within a small body of marble, which is surrounded by quartzofeldspathic gneiss **(fig. 15)**. Pre-Belt metamorphic rocks have been thrust over Paleozoic formations, which are exposed north and east of the mine. Because of poor exposures the position of this fault north of the Willow Creek mine is only approximately known. In the mine, metamorphic units strike con-

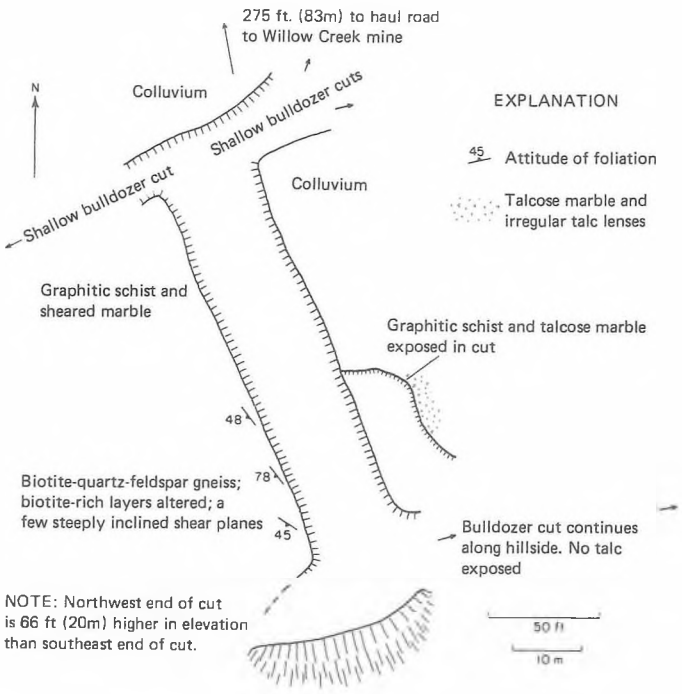

Figure 14—Greenhorn claims, Greenhorn Range (R. B. Berg and L. Swanson, July 1976).

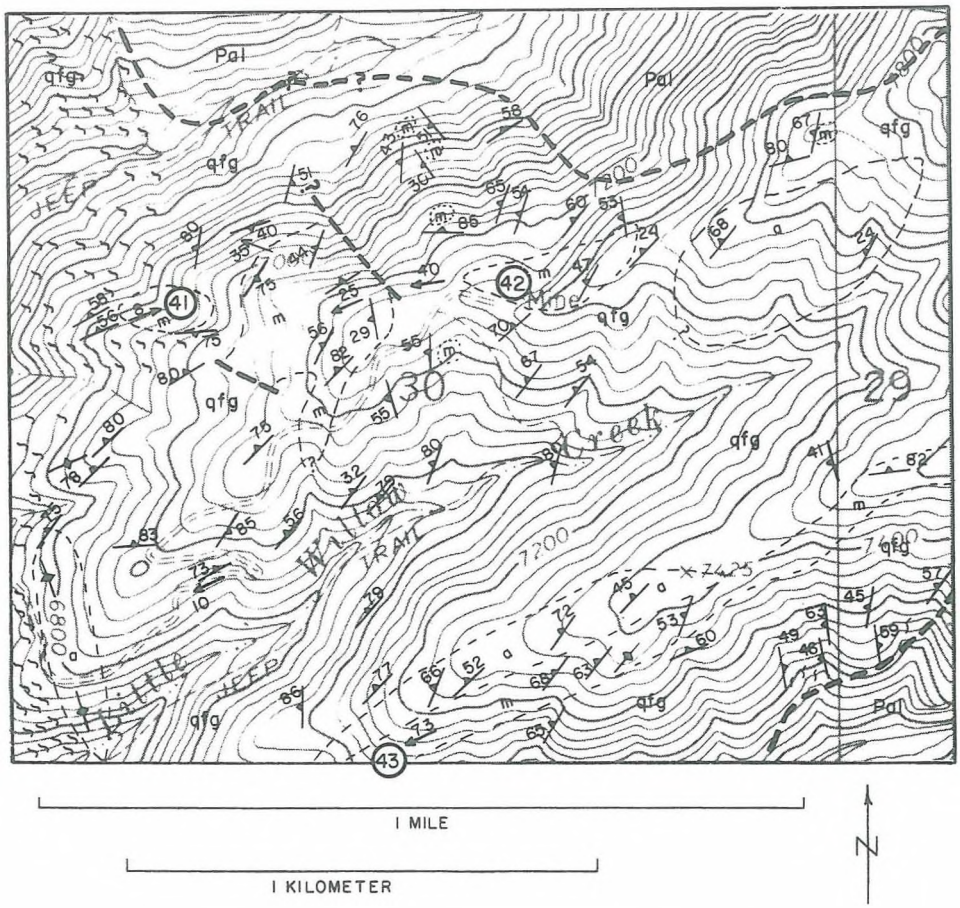

Figure 15—Geologic map of the area surrounding the Willow Creek mine (GH-42). The symbols used on this map are the same as those used on Sheets 2, 3.

sistently northeast and dip 40 to 70° NW. There is greater variation in the attitude of foliation north of the mine where outcrops are scarce on the heavily timbered north-facing slope. Shear planes cutting talc, chlorite and country rock are abundant at the mine. The large isolated body of calcitic marble west of the mine is barren of talc.

Figure 16 is a diagrammatic cross section through the Willow Creek ore body and shows the relationship between talc and associated rock types. The effect of post-talc faulting is not shown on this simplified cross section. The hanging wall of the deposit is biotite-quartz-feldspar gneiss, which has been altered to varying extent, the ultimate alteration product being chlorite. The first effect of the alteration was the replacement of biotite by chlorite. Further alteration resulted in the sericitization of the feldspar, and more intense alteration produced a rock that consists of chlorite and quartz. The final stage in the alteration sequence was dark-greenish-gray chlorite. A chemical analysis of a typical specimen of the chlorite is given in **Table 3.** Grain size of the chlorite varies considerably within the area of one thin section, for example from 10 to 150 μm. The chlorite contains rare local concentrations of idiomorphic zircon and idiomorphic crystals of apatite. On the basis of $\epsilon = 1.6353 \pm 0.0005$ and $\omega = 1.6397 \pm 0.0005$, one specimen of apatite is estimated to be approximately 76 percent fluorapatite, 12 percent hydroxyapatite and 12 percent chlorapatite. Some large flakes of silvery chlorite a centimeter across presumably have been formed by the replacement of coarse-grained biotite in the quartzofeldspathic gneiss. Rutile needles occur in some of the coarse-grained chlorite. Some specimens of chlorite are cut by many veinlets of talc a few millimeters to a centimeter in thickness. Most specimens of chlorite contain talc in sufficient concentration to be detected by x-ray diffraction analysis.

The alteration that produced chlorite from the biotite-quartz-feldspar gneiss also resulted in the formation of talc from the subjacent dolomitic marble. Large blocks of marble have been completely replaced by fine-grained white to pale-green talc. Some of the talc is medium green, colored by small grains of dark-green chlorite.

Most of the talc is very fine grained, some grains are less than 2 μm across, but even within a specimen of fine-grained material there are patches of coarser-grained feathery talc in which individual grains are 1 mm long. Talc pseudomorphs after tremolite blades are observed in one specimen. Veins of white quartz are rare in both the talc and the chlorite. Clasts of green chlorite 1 cm across in one specimen from a quartz vein are rimmed by a layer of talc about 1 mm thick. Perhaps talc formed by reaction of chlorite with silica-rich solutions, which added the necessary silica to make chlorite from talc and removed the alumina left over from that reaction.

Dolomitic marble on the footwall side of the ore body contains many small veinlets and pods of talc. The abundance of talc in this marble decreases to the southeast away from the ore body. Calcitic marble that contains abundant forsterite, mainly in grains smaller than 5 mm across, is exposed on the ridge just south of the mine. Some porphyroblasts of brown forsterite are several centimeters across, and a few of these are cut by chrysotile veinlets. Serpentine was also observed in thin sections of both the calcitic marble and the dolomitic marble. The serpentine occurs in small blebs, which may have formed by the complete re-

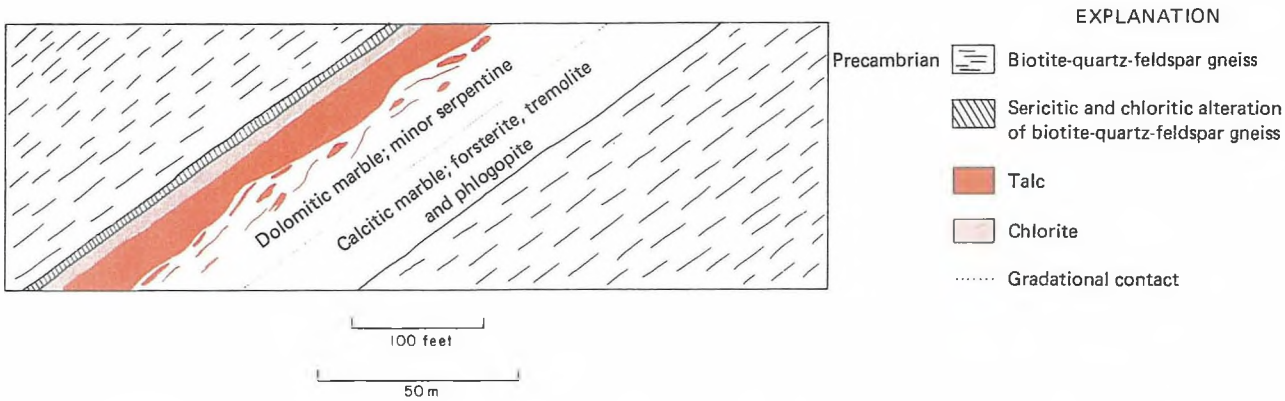

Figure 16—Diagrammatic cross section of the talc deposit at the Willow Creek mine showing the probable relationship between talc and host rock before post-talc faulting.

placement of forsterite. Phlogopite and tremolite also occur in the calcitic marble. Tremolite is typically gray to black because of abundant included graphite, and is concentrated in almost monomineralic layers a centimeter or two in thickness. No talc was identified either optically or by x-ray diffraction analysis from the calcitic marble. Sepiolite has been identified from this locality (Alice Blount, personal communication, 1977).

GH-43 Claims north of Willow Creek (Adam and Eve No. 1 and No. 2)

Location: SW¼ SE¼ sec. 30, T. 8 S., R. 3 W., Madison County. Home Park Ranch 7½-minute quadrangle. Approximately 16 miles (26 km) southeast of Alder.

Accessibility: The road to the prospect branches from the haul road for the Willow Creek mine at a sharp switchback above Little Willow Creek at an altitude of 6,920 feet (2,110 m). The haul road for the Willow Creek mine joins the Willow Creek road at the site of the talc-sorting plant.

Ownership: Sam and Goldie Maloney of Alder, Montana.

Description: Marble, quartzofeldspathic gneiss and sillimanite-biotite-garnet schist are exposed in six prospect cuts, all of which trend nearly perpendicular to lithologic layering of the metamorphic units. Marble is exposed in all but the highest cut, which is 240 feet (73 m) higher than the lowest cut. Talc pods less than 5 cm long and talc veinlets 3 to 4 cm thick, parallel to compositional layering of the marble, are exposed in the lower four cuts. Talc chips are found in the soil between the cuts in the area underlain by marble and also in a small area just east of the cuts. Although there is no large concentration of these chips, they were found in the soil over an area of approximately 300 by 1,500 feet (100 by 500 m).

Masses of sepiolite as long as 10 cm were found in the lowest cut. The sepiolite resembles splintered wood that has weathered grayish tan. A few thin chrysotile veinlets 2 mm thick occur in calcitic-marble.

GH-44 SW¼ NW¼ sec. 31, T. 8 S., R. 3 W. A trace of talc was found in the bottom of a prospect trench, which exposes marble for a distance of 45 feet (15 m).

GH-45 Talc occurrence south of Virginia City

Location: NW¼ NW¼ sec. 23, T. 7 S., R. 3 W., Madison County. Varney 15-minute quadrangle. Approximately 5 miles (8 km) south of Virginia City.

Accessibility: This area is 100 feet (33 m) south of the road between Barton Gulch and Alder Gulch where this road descends into Alder Gulch.

Ownership: Not known.

Description: A nearly vertical quartz vein 1 to 3 feet (0.3 to 1 m) thick separates quartzofeldspathic gneiss from calcitic marble. Foliation in the marble is parallel to the vein. Adjacent to the quartz vein the marble contains talc, tremolite and a trace of vermiculite. The bright-green vermiculite grains are less than 5 mm across and have presumably been produced by alteration of phlogopite. The bright green color suggests that this vermiculite is nickel bearing.

GH-46 Calverts claims

Location: SW¼ SE¼ sec. 32, T. 7 S., R. 3 W., Madison County. Varney 15-minute quadrangle. Approximately 8 miles (13 km) southwest of Virginia City.

Accessibility: The claims may be reached by following the Idaho Creek road to its end in the NW¼ of sec. 33. From that point the road to the claims is unimproved and steep in some places.

Ownership: The Calverts No. 1 through No. 4 claims were located by Frank Ludwick and Jim Ludwick (Alder, Montana), Jim Eby (Billings, Montana), and Carl Hafer, Sr. (Butte, Montana).

Description: A dolomitic marble layer with an exposed width of approximately 250 feet (76 m) strikes northeast and dips northwest **(fig. 17)**. Amphibolite lies northwest of the marble, and amphibolite and quartzofeldspathic gneiss lie to the southeast. Irregular veinlets and pods of talc, most of which are less than 10 cm thick, are exposed in all but the easternmost cut. Talc is most abundant in the largest cut, where a small amount of waxy green chlorite is also exposed. Because the chlorite is intermingled with the talc and there is no evidence of replacement of quartzofeldspathic gneiss, it is concluded that both the talc and the chlorite formed by alteration of dolomitic marble. Tremolite is found scattered throughout much of the marble, and in the westernmost cut, tremolite layers 3 to 5 cm thick have been replaced by talc.