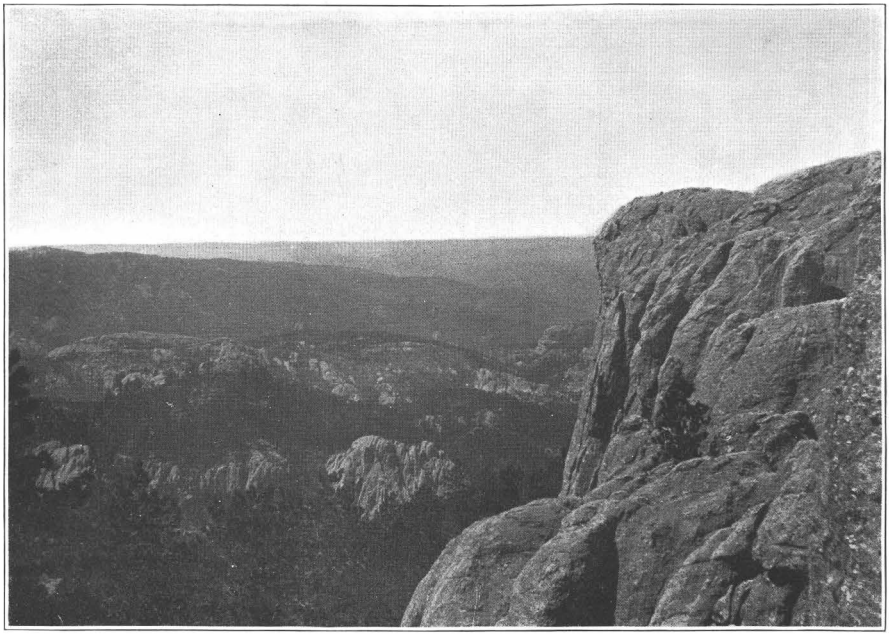

FIGURE 1.—VIEW NORTHWESTWARD FROM SUMMIT OF HARNEY PEAK

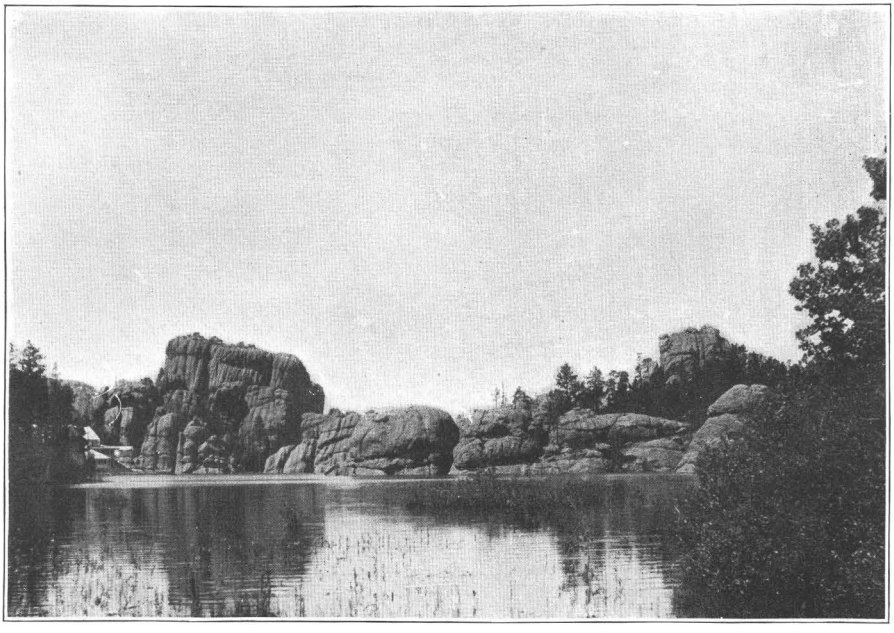

FIGURE 2.—SYLVAN LAKE, SOUTH DAKOTA
Artificially formed lake in southern granite area of Black Hills

SUMMIT OF HARNEY PEAK AND SYLVAN LAKE

[FROM BULL. GEOL. SOC. AM., VOL. 11, 1899]

EROSION FORMS IN HARNEY PEAK DISTRICT, SOUTH DAKOTA

BY EDMUND OTIS HOVEY

[*Abstract with discussion*]

The pre-Cambrian geology of the Black hills of South Dakota has been ably treated by Van Hise* before this Society, and by Newton,† Crosby,‡ Carpenter,§ and others elsewhere, and the present paper does not presume to attempt to add to the geological facts brought out by these observers. The surface features, however, of the granitic region near Harney peak are so very peculiar that the verbal descriptions of N. H. Winchell ‖ and Newton ¶ convey but an inadequate idea of the relief of the country, and a reproduction of some photographs taken last summer (1899) may not be without some value.

The so-called granite area forming the Harney Peak district and the culminating point of the Black hills is an irregular oval about 16 miles long from north to south and 10 miles wide, but it is by no means all granite. The central portion, including Harney peak, shows nothing but the coarse grained granite, the valleys between the resistant ridges being covered with soil and bearing forests of the Rocky Mountain pine up to the vertical walls of the granite ridges, so that no other rock seems to be exposed. The outer portion of the area, however, consists of numerous lenses or bosses of granite which have forced their way up through the mica-schists of the general region. The schists have suffered most from erosion and have left the granite standing in high, narrow ridges, the summits of which rise from 200 to 500 feet above the intervening valleys, and are often wholly inaccessible. The granite is intersected by numerous joint planes, and erosion has progressed in such a way as usually to produce sharp pyramidal and needle-like forms in the rock. The ends of the lenses being narrower than the middle, the terminal needles have disintegrated and worn down more rapidly than the others, and the upper portion of a vertical section is elliptical, a form which may or may not correspond with the original shape of the lense. This feature is well shown in figure 1 of plate 55, which represents the end of a ridge descending into the valley between two other ridges. That there has been no glaciation of the region is indicated by these jagged forms and the absence of grooved and polished surfaces and erratics.

Figure 1 of plate 53 shows a part of the view northwestward from the summit of Harney peak. The ridges of granite are seen projecting above the tree tops. The heavily wooded hills in the near distance are of schist. The outlook in every direction from the peak shows how intricate is the network of these lenses. Figure

* C. R. Van Hise: The pre-Cambrian rocks of the Black hills. Bull. Geol. Soc. Am., vol. 1, 1890, pp. 203–244.

† Henry Newton, E. M., and Walter P. Jenny, E. M.: Report on the geology and resources of the Black hills of Dakota, with atlas, 4to, Washington, 1880.

‡ W. O. Crosby: Geology of the Black hills of Dakota. Proc. Boston Soc. Nat. Hist., vol. 23, 1888, pp. 488–517.

§ Franklin R. Carpenter: Preliminary report of the Dakota School of Mines upon the geology, mineral resources, and mills of the Black hills of Dakota, 1888.

‖ William Ludlow: Report of a reconnaissance of the Black hills of Dakota, made in the summer of 1874, 4to, Washington, 1875; Geological report by N. H. Winchell, pp. 21–66. Pp. 42–46.

¶ Geology of the Black hills, pp. 65–80.

2 of the same plate gives a good general idea of the jointing in the broad portion of a long granite ridge at Sylvan lake, about 4 miles south of Harney peak. The lake has been formed artificially by throwing a dam across a narrow gorge through which a small stream finds its way. It is evidently not a "rock basin." The granite here contains a large proportion of muscovite, so much in fact that the attempt has been made to exploit it commercially. This ridge is comparatively broad and the forms produced by disintegration and erosion are more rounded than they are in some other parts of the district. The most striking and interesting of the erosion forms are those to be seen in "Cathedral park," a small area about 2 miles southeast of Harney peak, where the narrow ridges of granite have been weathered into a remarkable series of jagged pinnacles, a few views of which are reproduced on plates 54, 55, and 56. The ridges now standing are divided into plates the long diameters of which are parallel with the main system of joints in the region, or about northwest and southeast. The main system of joint planes is crossed at various angles by subordinate planes of fissure. The weathering has been most extensive along the more persistent joints, and the combination has produced the almost endless variety of jagged forms which characterize the Harney Peak district. Degradation along strong fracture planes nearly at right angles to one another has produced the angular shafts in the granite which are indicated in figure 1, plate 56. These shafts are bare of fresh debris, their bottoms being well grassed over.

The pegmatitic character of some of the ridges near the outer portion of the main granitic area about Harney peak, in the Black Hills, is shown on a gigantic scale in the knoll which forms the principal working of the famous Etta tin mine. This is a mass of albite, quartz, and greenish white muscovite in which occur enormous crystals of spodumene. The rock carries a small amount of cassiterite and some columbite, and has been called "greisen," incorrectly, by the miners, on account of the presence of the tin ore. The spodumene crystals lie at all angles in the matrix, like so many great sticks of timber, and a few of them are shown in figure 2 of plate 56. One crystal that I measured roughly in the side of one of the old adits was more than 30 feet long and 30 inches wide. The crystals are crossed by numerous fissures, are bounded by imperfect planes, and all seem to lie on edge in the rock. None were observed which had been disturbed by faulting. Many were surrounded by zones of alteration products. The spodumene was thrown on the dump while the property was being worked for tin, but now it is being quarried in a small way for commercial purposes for its lithia content, the cassiterite being thrown to one side.

In the discussion which followed S. F. Emmons said:

The granite needles apparently result from the wearing away of the softer schists that once surrounded them. The schists are generally covered by surface accumulations and rarely show distinct outcrops. Inclusions of them are, however, found in the central granite mass of Harney peak, and a section is exposed in a road cutting near the hotel. With increased distance from the central Harney Peak mass the granite bodies assume a more distinctly lenticular form, and stand out more and more isolated in the forest covered region where few outcrops of rocks other than granite can be detected. On the outer edges of the area in which granite exposures are found, the granite assumes the form of flat-lying pegmatite veins dipping gently away from the Harney Peak mass.

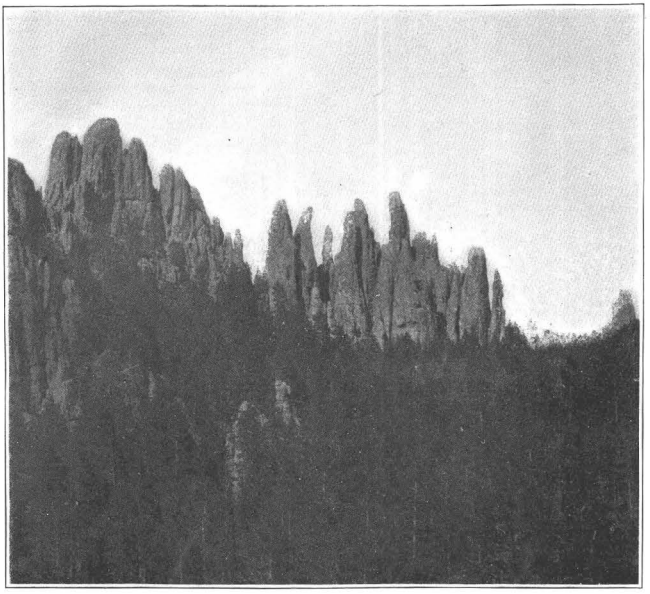

FIGURE 1.—THE "NEEDLES" NEAR HARNEY PEAK
View from south

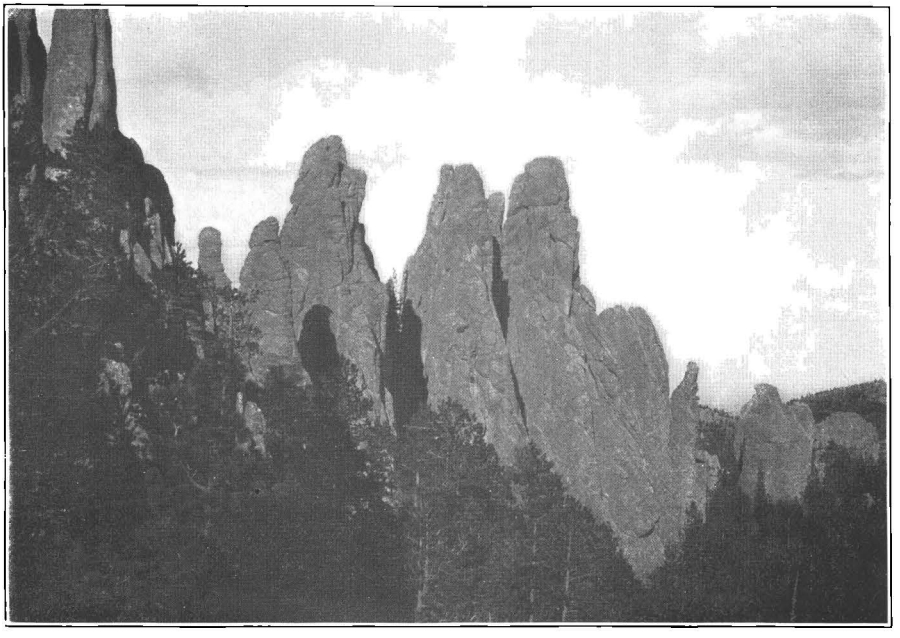

FIGURE 2.—THE "NEEDLES" FROM SOUTHWEST

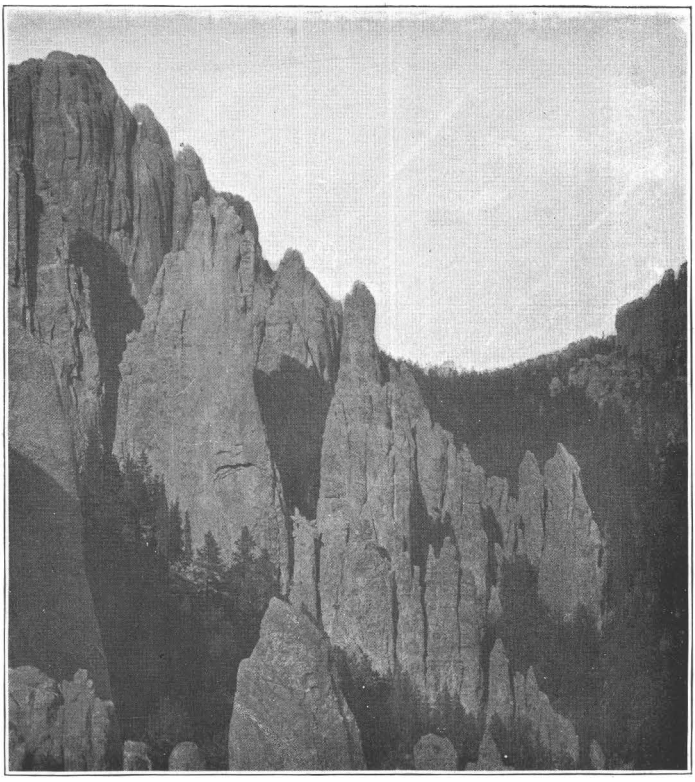

FIGURE 1.—CRAGS NEAR THE "NEEDLES"—LOOKING EAST

View shows end of a lens descending into the valley between two other lenses

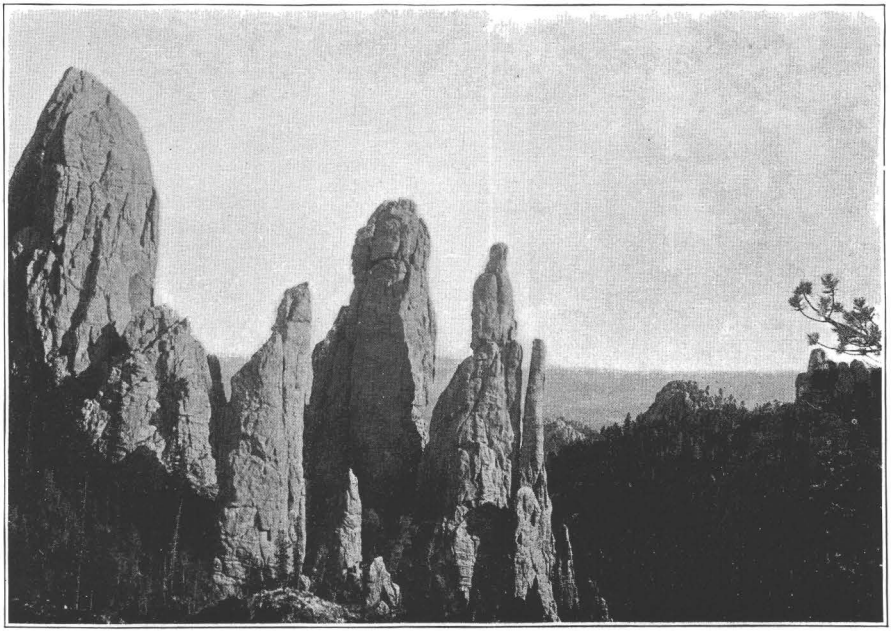

FIGURE 2.—CRAGS NEAR THE "NEEDLES"—LOOKING SOUTH

CRAGS NEAR THE NEEDLES