

glacier deepens its bed by corrasion, until there is a decided reverse curve in the profile of the slope. The upper part is concave upward, the lower part is a convex ridge near the rim of the channel cut by the valley glacier. With decrease in abundance of snow, the slope glaciers may dwindle to bowls of snow (*wanner* and *mulden*), and by selective erosion they may become ridge-cutting cirques.

Glacial movement is essentially along shearing planes; these planes are parallel to the great friction of the glacier bed and are for that reason approximately trough-shaped. The glacier's whole movement is accomplished by means of a multitude of such planes. The planes show at the base and edges of the glaciers; on the average they are from one to two meters apart. Thus it results that, in proportion to the total amount of movement in a glacier, the shearing along each plane is very small. The blue bands are due to the regelation of the shear planes after they have been melted by the over-pressure or by friction.

Ice crystals are found in two types, those precipitated from the atmosphere and those formed by freezing waters. In one place a 20-cm. layer of névé consisted of vertical standing prisms; they were $\frac{1}{2}$ -1 cm. in diameter and 10 cm. long arranged in two layers of 10-cm. crystals. In the higher parts of the snow fields, beautiful rosettes of crystals bedeck the snow surfaces. The diameter of the rosettes varies from 5 to 20 cm.

Most of the evidence of Pleistocene glaciation has been obliterated by the action of insolation and frost. From floral remains there seems to have been a climate warmer by 2.5-3° C. preceding a recent uplift of about 400 feet.

T. T. Q.

Kanawha County. By CHARLES E. KREBS. West Virginia Geological Survey, County Reports, 1914. Pp. 679, pls. 32, figs. 14.

County reports have been completed for about one-half the counties of this state. Kanawha County is the first to be treated in a separate volume and its importance is such as to justify a full report. It is among the leading counties of the state in production of coal, and is rich in petroleum and building-material.

This report follows the general plan adopted in previous reports. Part I treats of the historical and industrial development and physiography. Part II takes up the stratigraphy in detail. About forty general sections of Carboniferous outcrops are given with several times that number of partial sections.

Under mineral resources the oil and gas districts are described in detail with a number of well-records from each district. Statistics on coal production place Kanawha County third in rank of the counties of the state for 1912, with a total of 5,606,522 tons. This chapter treats also of the character and distribution of the coal beds with estimates on the total supply. Clays and road and building-materials are reported in less detail. A chapter on the soils of the county is copied from the report of the U.S. Bureau of Soils on Kanawha County.

Under separate cover three maps accompany this report, a topographic map, a general and economic geology map, and a soil map. A valuable feature of the economic geology sheet is found in the structure contours. The Pittsburg coal horizon is the key formation in the western part, and the Kanawha Black Flint in the eastern. This map shows several areas in which the geologic structure appears favorable for oil and gas, that have not been prospected.

W. B. W.

Geology and Geography of a Portion of Lincoln County, Wyoming.

By ALFRED REGINALD SCHULTZ. Bull. U.S. Geol. Survey,
No. 543, 1914. Pp. 136.

The area described lies in the central part of Lincoln County in the extreme western part of Wyoming, east of the Salt River Range and west of Green River. Under the head of geography are discussed geographic positions, topography, altitudes, railroad and stage routes, geographic names, climate, arable land, and vegetation. The stratigraphic succession, beginning with the oldest rocks, is as follows: Cambrian, undivided (Ordovician, Silurian (?), and Devonian), undifferentiated Pennsylvanian and Mississippian, Pennsylvanian (Weber quartzite), Permian (?) (Park City formation), Lower Triassic (Woodside formation, Thaynes limestone, Ankareh shale), Jurassic or Triassic (Nugget sandstone), Jurassic (Twin Creek limestone, Beckwith formation), Upper Cretaceous (Bear River formation, Colorado group [Aspen formation, Frontier formation, Hilliard formation], Montana group [Adaville formation]), Cretaceous or Tertiary (Evanston formation), Eocene (Wasatch group [Almy formation, Knight formation, Green River formation]), Quaternary (Pleistocene and Recent).

Deposition was interrupted possibly at several times in the early Paleozoic. An unconformity based on fossil evidence, which shows the lower Cretaceous to be absent, occurs between the Beckwith formation (Jurassic) and the Bear River formation (Upper Cretaceous). Profound