Reports

Stratigraphy of the Wisconsin Range, Horlick Mountains, Antarctica

Abstract. *The Wisconsin Range consists of a basement complex of granitic and metamorphic rocks unconformably overlain by about 550 meters of Upper Paleozoic sedimentary rocks. The base of the Upper Paleozoic succession is composed of the Buckeye formation, a tillite, which varies in thickness from 80 to more than 140 meters. Overlying the Buckeye formation are the Weaver and Queen Maud formations, with a combined thickness of about 455 meters, characterized by a prolific* Glossopteris *flora, indicative of a Permian age.*

The Wisconsin Range, in Antarctica, formerly known as the Western Horlick Mountains, is composed of a series of dissected escarpments, extending from about longitude 122°W to 132°W, between latitudes 85° and 86.1°S (Fig. 1). Flat-lying Upper Paleozoic sedimentary rocks are exposed in nearly vertical cliffs along the tops of the escarpments in the easternmost and westernmost parts of the Wisconsin Range. The most complete sections are along the head of the Reedy Glacier.

Previous to 1964 the Wisconsin Range had not been examined geologically, although detailed investigations had been carried out in the Ohio Range, about 160 km to the east, and in the Queen Maud Mountains, about 160 km to the west. Examination of the rocks in the Wisconsin Range is essential for correlation between those two areas.

The Upper Paleozoic sedimentary rocks rest unconformably on a basement of granitic and folded metamorphic rocks. Two lithologic associations of metasediments have been distinguished. The more extensive association is composed of highly deformed phyllite and schist, striking northeast, approximately parallel to the mountain range. The other, less extensive and less deformed, association consists of slightly metamorphosed, coarse-grained sandstone, with minor amounts of limestone and shale. Near the Robert Scott Glacier, rocks similar to the latter association contain trilobites of probable Middle Cambrian age (*1*). The age relationship of the two associations of rocks is not known because they were not observed in contact. However, higher grade of metamorphism, more intense deformation, and lack of fossils in the phyllite-schist rocks may imply a greater age.

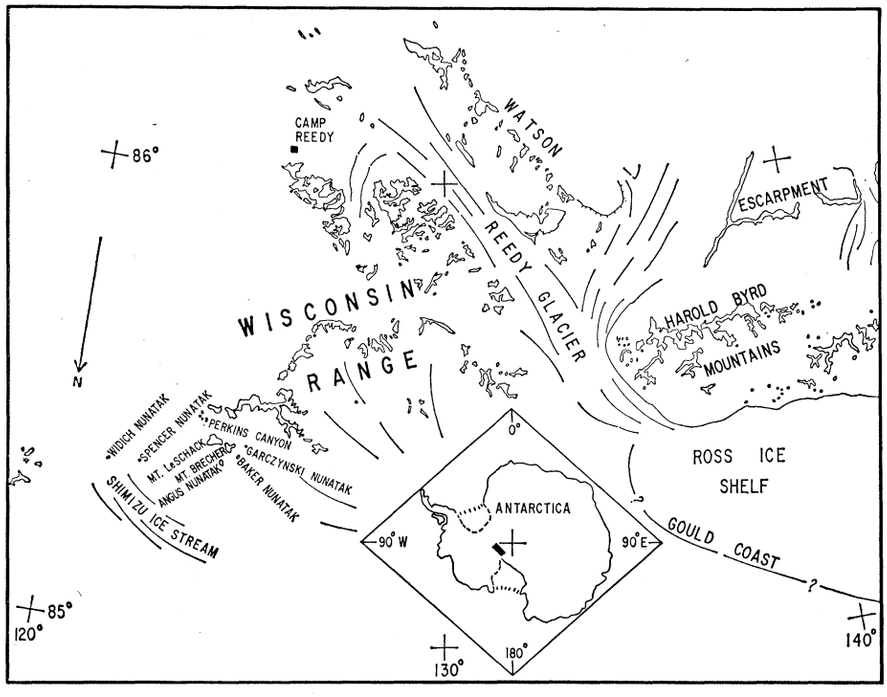

Fig. 1. Index map of the Wisconsin Range, Horlick Mountains, Antarctica.

Three distinct formations, totaling about 550 m in thickness, are recognizable in the Upper Paleozoic sedimentary succession in the Wisconsin Range (Fig. 2). These formations, in ascending order, are the Buckeye, Weaver, and Queen Maud formations. The Buckeye formation is correlative with the Buckeye (Tillite) formation in the Ohio Range, the type locality (*2*); the Weaver and Queen Maud formations here are both equivalents of these same formations where first defined in the Robert Scott Glacier area (*3*).

The Buckeye formation in the Wisconsin Range is dominantly a tillite that varies in thickness from 80 to more than 140 m. The top of the unit is missing at the thickest exposure on Mount LeShack in the easternmost part of the range. Near the Reedy Glacier the formation varies in thickness from 80 to more than 110 m, with local relief on the basal surface probably in excess of 30 m. The tillite rests on a striated, grooved, polished, and mammalated glacial pavement; the ice appears to have moved in an easterly direction.

Locally at the base of the Buckeye formation is a stratified unit as much as 30 m thick which is generally located in topographic lows on the basement erosion surface. It is generally well bedded, but poorly sorted. Some boulders in these deposits are more than 1 m in diameter, and are usually surrounded for a few centimeters by disrupted or bent beds. Glacial striae and polish are present below and within this stratified deposit. This unit is considered to be of glacio-lacustrine origin.

Overlying this basal unit, apparently with gradational contact, is the tillite proper. The tillite, greenish-gray, is devoid of bedding and is characterized by an abundance of striated and faceted phenoclasts. Boulders up to 5 m in diameter are present locally. The matrix of the tillite is clayey to silty with no apparent sorting. Minor amounts of

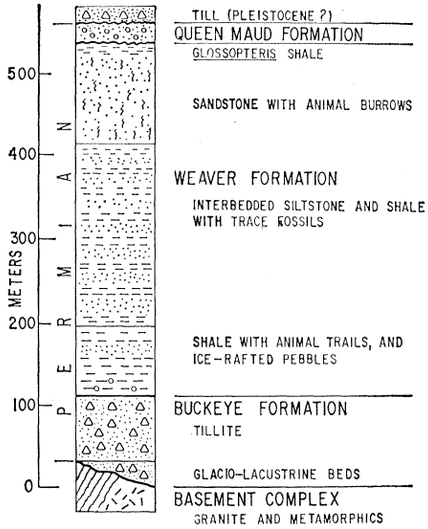

Fig. 2. Composite stratigraphic section of the Wisconsin Range Horlick Mountains, Antarctica.

varve-like shale and bedded sandstone, usually about 1 m thick, are interbedded with the tillite.

The Buckeye formation grades upward into the Weaver formation, which is divisible into three members totaling about 430 m in thickness. The lower member, about 85 m thick, consists of shale similar to the underlying tillite, except for the well-developed bedding and fissility which is absent from the tillite. The contact of the lower member with the Buckeye formation is placed at the base of the lowest black shale above which no more tillite occurs. Scattered throughout the lower part of the black shale are erratic, probably ice-rafted, pebbles and cobbles, locally several centimeters in diameter. Minor amounts of sandstone are interbedded with the shale. Sinuous animal trails are abundant. This black shale is thought to have formed in a restricted basin into which icebergs floated.

The middle member of the Weaver formation, about 220 m thick, consists of rhythmically interbedded siltstone and shale, each bed averaging only a few centimeters in thickness. Numerous trace fossils and well-developed sole markings are characteristic of this unit; carbonaceous matter is abundant.

The upper member of the Weaver formation, about 125 m thick, is composed primarily of fine- to medium-grained, well-sorted sandstone which weathers to form massive cliffs. The sandstone is well stratified and contains abundant low-angle planar cross-bedding. Numerous animal burrows, mostly oriented perpendicular to bedding, are present throughout the sandstone. At the top of this upper member occurs a thin black shale with a rich *Glossopteris* flora.

The entire Weaver formation may be interpreted as a regressive sequence, starting with a restricted basin which formed as the ice melted and in which black shale was being deposited. As the regression continued, silty materials were transported into the basin and interbedded with the shale. The upper member is considered to be a beach and near-shore deposit. Finally, the area was occupied by swamp and lagoonal environments in which the *Glossopteris* flora grew. Units at this stratigraphic position similar to the Weaver formation are found discontinuously from the Ohio Range to the Queen Alexandra Range, a distance of several hundred kilometers. It is difficult to visualize deposits of such wide areal extent having formed in a lake or in isolated lakes, as some have suggested (*4*). It is more probable that they formed in a marine to brackish near-shore environment.

Disconformably overlying the upper *Glossopteris*-bearing black shale of the Weaver formation is a coarse-grained, conglomeratic sandstone. This sandstone is conspicuously cross-bedded, and is characterized by numerous stringers of rounded pebbles of grayish quartz. The cross-bedding is of festoonal character. The sandstone is about 25 m thick, but the top of the unit is not present. This sandstone is correlative with the quartz pebble conglomerate which is the basal unit of the Queen Maud formation in the Robert Scott Glacier area (*3*), and represents the first major basinward advance of conglomeratic materials across this area. Overlying this sandstone is indurated till more than 30 m thick, which is probably Pleistocene in age, but could conceivably be Pliocene (*5*).

The stratigraphic succession in the Wisconsin Range is generally similar to that of the Ohio Range and the Robert Scott Glacier area. The correlation and thickness of rocks in these three areas are shown in Fig. 3. A *Glossopteris* flora from the Mount Glossopteris and Queen Maud formations in the Ohio Range and Robert Scott Glacier area are indicative of a Permian age (*3, 6*). The *Glossopteris* flora in the Wisconsin Range appears to be of a similar age (*7*). In the Ohio Range, spores of probable Permian age have been found in a shale near the top of the Buckeye formation (*8*). In the Ohio Range, the Buckeye formation rests disconformably on strata as young as Early Devonian. The lower age limit of the sedimentary succession in the Wisconsin Range is unknown, but is probably not much older than Permian.

	OHIO RANGE	WISCONSIN RANGE	ROBERT SCOTT GLACIER
Permian	Mt. Glossopteris formation (600 m)	Queen Maud formation (25 m)	Queen Maud formation (600 m)
		Weaver formation (430 m)	Weaver formation (150 m)
	Discovery Ridge formation (165 m)	Upper member Middle member Lower member	Upper member Middle member Lower member
?	Buckeye (Tillite) formation (225 to 300 m)	Buckeye formation (80 to 140 m)	Scott Glacier formation (0 to 20 m)
	Unconformity		
Devonian	Horlick formation	Not present	Not Present

Fig. 3. Correlation chart of the area from the Ohio Range to the Robert Scott Glacier, Antarctica (thickness of units in meters).

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References and Notes

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