Antarctica: Geology of the Ellsworth Mountains

Abstract. Geologic reconnaissance indicates that the Ellsworth Mountains consist mainly of thousands of feet of folded, slightly metamorphosed, clastic sedimentary rocks of unknown age. Three major stratigraphic units are recognized, but only fragmentary fossils have been found. The folding is asymmetric, overturned, or recumbent; fold axes strike north, 10° to 20° west. Basic igneous sills occur in the northern Heritage Range.

The Ellsworth Mountains were first sighted by Lincoln Ellsworth, in whose honor they have since been named, during his historic flight across the Antarctic in 1935. They were next seen during the 1957–58 season when an oversnow traverse from Byrd Station briefly visited outlying nunataks about 11 miles west of the northern Sentinel Range (*1*). One of us (C.C.), while serving as geologist for the 88th meridian airborne traverse, studied a nunatak in the northwest Heritage Range in December 1959 (*2*). The rest constituted a four-man expedition that traveled about 750 miles by motor toboggan to conduct a geologic reconnaissance of the Sentinel and northeastern Heritage ranges during the 1961–62 season (Fig. 1). This preliminary report summarizes the principal results which have been achieved to date; another field program is planned for 1962–63, and further laboratory study of the specimens received last June will be undertaken.

The Sentinel Range is separated from the Heritage Range to the south by the prominent east-flowing glacier at 79°08′ south latitude. The Sentinels are a linear group of spectacular mountain peaks, the highest about 16,800 feet in elevation. Slopes are characteristically steep, and sharp arêtes are common along the crest and flanks of the range. The western side of the range consists of a lofty, mainly snow-free escarpment, but to the east the descent to the snow surface is more gradual and is marked by many lesser peaks and ridges separated by valley glaciers and icefalls. In contrast, the Heritage Range contains numerous small mountain groups and massifs separated by large glaciers; the peaks here are lower in elevation and less striking in outline and relief.

In the areas visited, the Sentinel Range is composed exclusively of a thick sequence of slightly metamorphosed clastic sedimentary rocks of unknown age. These strata can be divided into three distinct units. The lowest is at least 4000 feet thick and consists mainly of quartzite with minor argillite, subgraywacke and conglomerate. Bedding thickness ranges from 2 inches to 5 feet; color is generally medium to dark gray, but light tan to white beds occur. Cross-bedding is abundant and well developed, and ripplemarked surfaces are common.

Overlying this unit, with seeming conformity, is a conglomerate composed of pebbles, cobbles, and boulders of mixed sedimentary, igneous, and metamorphic rocks in a matrix of gray micaceous quartzite and argillite. This rock is well indurated, and a rude secondary cleavage is locally developed. The total thickness of this massive unit is from 2000 to 3000 feet; very faint bedding surfaces, several hundred feet apart, are visible from a distance. This unit may prove to be a tillite, but its genesis requires further study.

The conglomerate is overlain, possibly with unconformity, by a third unit distinguished by its dark gray color and abundant large folds. A section of 2046 feet was measured, and a minimum of another thousand feet of strata are included in this unit. It consists of impure quartzite and metamorphosed subgraywacke interbedded with slate; rock cleavage is well developed, and cross-bedding and ripplemarks are common.

Fossils are exceedingly rare in the

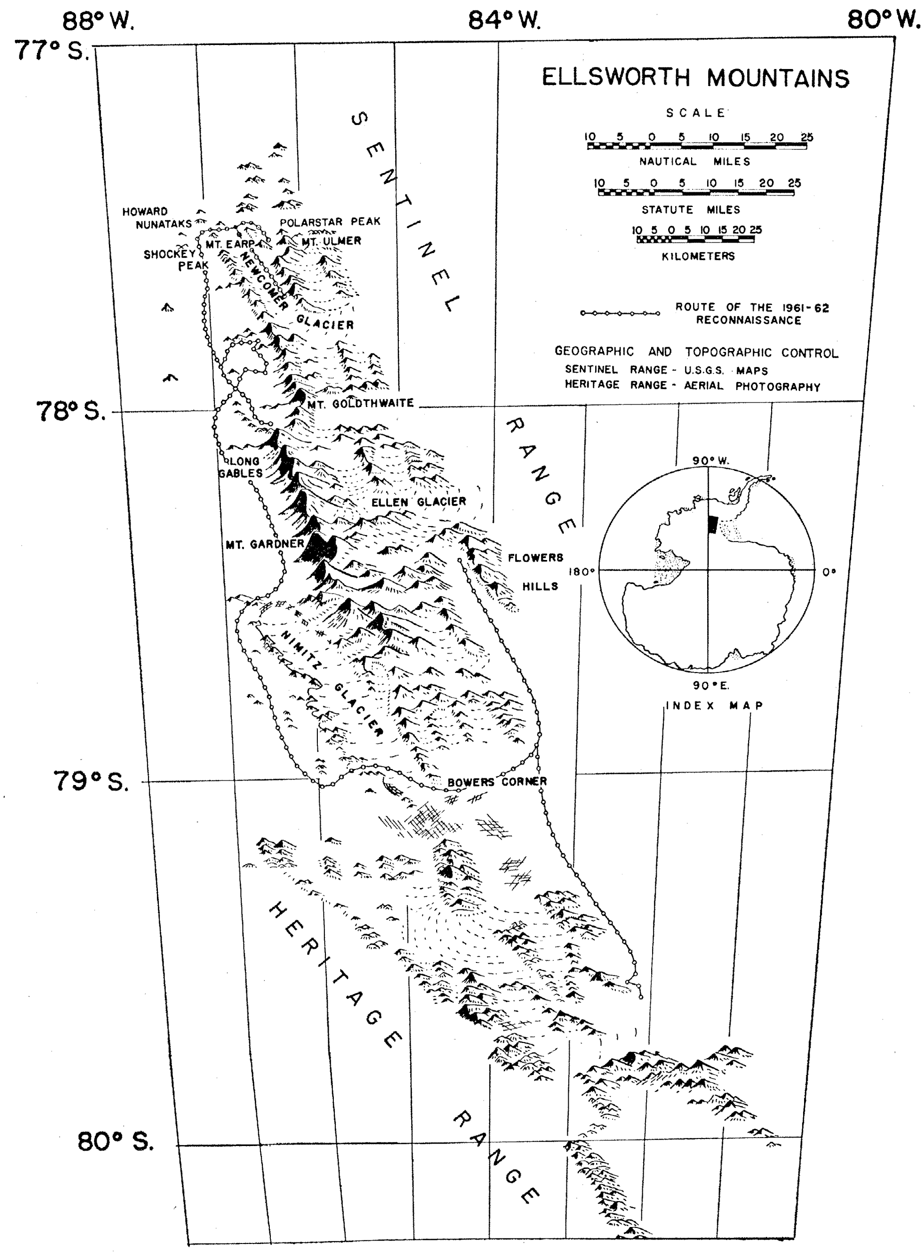

Fig. 1. Route of the 1961–62 reconnaissance.

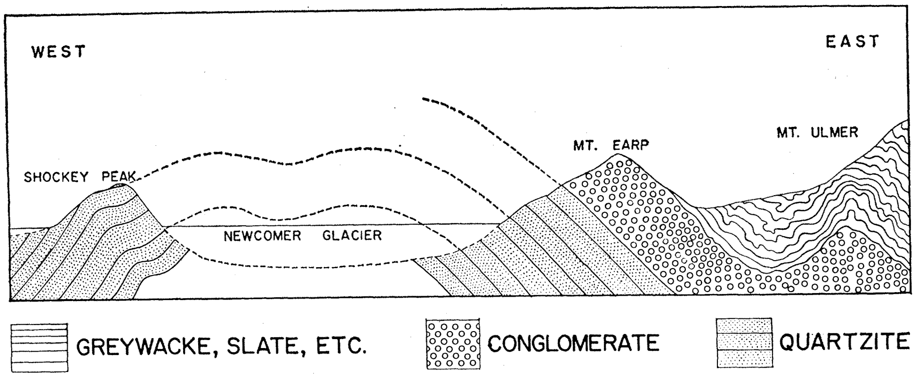

Fig. 2. Generalized west-east geologic cross section from Shockey Peak to Mount Ulmer, northern Sentinel Range.

sections studied, and possible fossils, mainly fucoidal impressions and probable worm borings, were discovered at only 12 localities. Most of these specimens are poorly preserved, and no generic or specific identifications have been made as yet. This material is receiving further study, and the age of these sedimentary rocks is at present unknown.

The strata of the Sentinel Range have been deformed into a complex set of folds whose axes plunge about 5° to N.10°–20°W., roughly parallel to the trend of the mountains (Fig. 2). Most of these folds are asymmetric or overturned; the axial planes generally dip steeply to the east although recumbent folding is also present. The large folds defined by the principal statigraphic units have wavelengths of up to 2 miles. Superimposed upon these major folds are many smaller ones, especially in the lower and upper of the three units, with wavelengths of tens or hundreds of feet; these smaller folds are commonly tight and locally isoclinical. Important faulting has not been demonstrated in these strata, although one steep strike fault of indeterminate displacement was observed in a spur along the western base of the Sentinels. All the original sedimentary rocks have undergone low-grade metamorphism, and locally they have developed secondary, steeply inclined foliation.

The northern Heritage Range consists mainly of quartzites believed to correlate with the lowest unit in the Sentinels. A typical rock contains mainly quartz grains with minor sodic plagioclase, sericite, and chlorite and traces of titanium oxide, iron oxide, apatite, epidote, zircon, calcite, muscovite, and microcline. Layers (1 mm) of detrital heavy minerals, mainly rounded garnet and iron oxide, occur in the quartzites. White quartz veins with epidote and chlorite are abundant. In the northeastern part of the range five basic sills up to 100 feet thick have intruded these strata.

JOHN J. ANDERSON
THOMAS W. BASTIEN
PAUL G. SCHMIDT
JOHN F. SPLETTSTOESSER
CAMPBELL CRADDOCK
Department of Geology,
University of Minnesota, Minneapolis

References

1. V. H. Anderson, *Ohio State Univ. Res. Found.*, Project 825, Rept. No. 2, pt. VIII (1960), p. 20.
2. E. Thiel, *Polar Record* **10**, 67, 335 (1961).

10 September 1962

Method of Introducing Tritiated Thymidine into the Tissues of Hydra

Abstract. Although normal hydras resist the uptake of tritiated thymidine into their tissues, regenerating forms contain a very heavy label in interstitial cells, epitheliomuscular cells, and digestive cells of the gastrodermis if the animals are allowed to regenerate in a medium containing the isotope. Preliminary results suggest that during early regeneration active wound repair is not effected by interstitial cells which divide and then begin to differentiate, but through differentiation of interstitial cells which are nondividing or which have partially begun to differentiate. Dividing interstitial cells probably function to restore the animal's original embryonic reserve.

The hydra is virtually impermeable to most exogenous free compounds. This impermeability is probably due to the mucous coat which covers the entire epidermis of the animal. Traditional vital dyes, such as methylene blue, penetrate the tissues of the animal extremely slowly unless the animal is immersed in highly concentrated solutions. To our knowledge, the only radioactive materials which have been found to penetrate the tissues of the animal from the external medium are labeled glycine (*1*) and carbon dioxide (*2*), both of which are small molecules.

Our attempts to introduce tritiated thymidine into intact animals had been singularly unsuccessful. However, we have recently devised a simple method for introducing this isotope which we feel will be applicable to other coelenterates and to flatworms, which, because of their mucous coat, are also highly impermeable.

The species of hydra employed in the following experiment was *Hydra pseudoligactis*. The animals were reared by the method of Loomis and Lenhoff (*3*). Animals chosen for experimental purposes were starved 24 hours, and then excised through the middle of the gastric region or just beneath the hypostome. The proximal portions of the hydras were then placed in 50 ml of Versene-water buffered with sodium bicarbonate (*3*). Tritiated thymidine, in a concentration of 0.5 mc/ml, was added to the solution to produce a specific activity of 10 μc/ml. Regenerating animals were left in the incubating medium for periods of 10 minutes, 30 minutes, 1 hour, 2 hours, 6 hours, 9 hours, 12 hours, 18 hours, 24 hours, and 48 hours. After removal from the solution the hydras were washed thoroughly in three changes of Versene-water, relaxed in 10-percent alcohol, and fixed in Bouin. The animals were then dehydrated, embedded in paraffin, and sectioned at 5 μ. The sections were then coated with Kodak type NTB3 No. LSB3-9-1 emulsion, dried, and placed in a deepfreeze for 2 weeks. The emulsion was developed in Dektol, fixed in hypo, washed, stained in 0.5-percent toluidine blue buffered to *p*H 8, destained in 50- or 70-percent alcohol, cleared in xylene, and mounted in Permount (*4*).

Animals incubated in the thymidine for 10 minutes showed a very significant label in interstitial cells and digestive cells of the gastrodermis. No cell was counted as labeled unless there