

7-1972

# Glacial Geology Near McMurdo Sound and Comparison with the Central Transantarctic Mountains

Paul Andrew Mayewski  
*University of Maine*, paul.mayewski@maine.edu

Follow this and additional works at: [https://digitalcommons.library.umaine.edu/ers\\_facpub](https://digitalcommons.library.umaine.edu/ers_facpub)



Part of the [Glaciology Commons](#), [Hydrology Commons](#), and the [Sedimentology Commons](#)

---

## Repository Citation

Mayewski, Paul Andrew, "Glacial Geology Near McMurdo Sound and Comparison with the Central Transantarctic Mountains" (1972). *Earth Science Faculty Scholarship*. 209.  
[https://digitalcommons.library.umaine.edu/ers\\_facpub/209](https://digitalcommons.library.umaine.edu/ers_facpub/209)

This Article is brought to you for free and open access by DigitalCommons@UMaine. It has been accepted for inclusion in Earth Science Faculty Scholarship by an authorized administrator of DigitalCommons@UMaine. For more information, please contact [um.library.technical.services@maine.edu](mailto:um.library.technical.services@maine.edu).

river level to the tops of the ice wedges. The remaining 90 centimeters of fill above is ice free, and the transition from ice wedge to sand wedge is abrupt. The sand-wedges capping the ice are of coarse and fine sand (figs. 1 and 2), little different from alluvium in one wedge and noticeably finer in another.

A feature of the overlying alluvial fan surface is the total lack of disturbance of any kind. No polygonal ground is present at the surface, despite the presence of open cracks in ice at depth. This implies wedge growth and decay prior to fan development. Adjacent to the fan, large, well developed polygons occur, and all surface cracks show signs of recent collapse of sand into them. There is no difference in the amount of water available to these two areas, and the margins of the fan clearly can be seen to overlap the wedged surface.

The contrast in surface between the fan and the surrounding area would be less striking if the well-developed lag gravel surface on the alluvial fan did not also possess many good ventifacts, demonstrating that it too is of considerable age. The degree of faceting of the lag gravel and the apparent source of the fan strongly suggest that the alluvial fan overlying the Onyx River alluvium is of Alpine II age (Calkin *et al.*, 1970).

Alpine II materials are considered to be of the order of 0.5 million years in age. Current estimates of the age are trending upward (0.5 million years, Calkin

*et al.*, 1970; and 0.6 million years, Behling, 1971). This past season, the authors located an abundance of basaltic bombs on the surface of an Alpine II lateral moraine of Meserve Glacier. These should provide a minimum age for the Alpine II glacial event if the material proves satisfactory for potassium-argon dating. The Alpine II event is known to have occurred after an eruptive event dated at 2.5 to 3.4 million years (our interpretation of a potassium-argon age by Dr. Robert Fleck, in Behling, 1971).

The evidence suggests that the ice wedges are no longer active, being totally deprived of a viable moisture source. Degradation of the ice-cemented layer and ice wedges with simultaneous replacement of ice wedge by sand infilling has produced sand casts of the former ice wedges. At least some of the abundant sand wedges in the dry valley area must be degraded ice wedges, and many are of great antiquity.

This work was supported by National Science Foundation grant GV-28804.

#### References

- Behling, R. E. 1971. Chemical weathering in Wright Valley. *Antarctic Journal of the U.S.*, VI(5): 214-215.  
Calkin, P. E., R. E. Behling, and C. Bull. 1970. Glacial history of Wright Valley, southern Victoria Land, Antarctica. *Antarctic Journal of the U.S.*, V(1): 22-27.

## Glacial geology near McMurdo Sound and comparison with the central Transantarctic Mountains

P. A. MAYEWSKI

*Institute of Polar Studies  
The Ohio State University*

Work begun in 1970-1971 in the central Transantarctic Mountains from camps at McGregor and Amundsen Glaciers (Elliott and Coates, 1971) was extended during December 1971 and January 1972 into the ice-free areas between Mount Feather and the Convoy Range (fig. 1). Six tent camps were established during the 1971-1972 season; transport and reconnaissance were supplied by the VXE-6 helicopters, and the author was assisted in the field by Robert S. Wilkinson.

Glacial geologic results of the 1970-1971 season were twofold. Three systems of lateral moraines were differentiated within each of the valleys of the Shackleton, Amundsen, and Scott Glaciers as part of a broad geologic mapping program. Also, new information was collected about the Sirius Formation, as named by Mercer (in press). The semilithified Sirius Formation is composed of two parts—a lower massive till and an upper mixture of massive till and stratified



M. J. McSaveney

Figure 2. Ice wedge beneath coarse-sand wedge to left of blade of ice axe

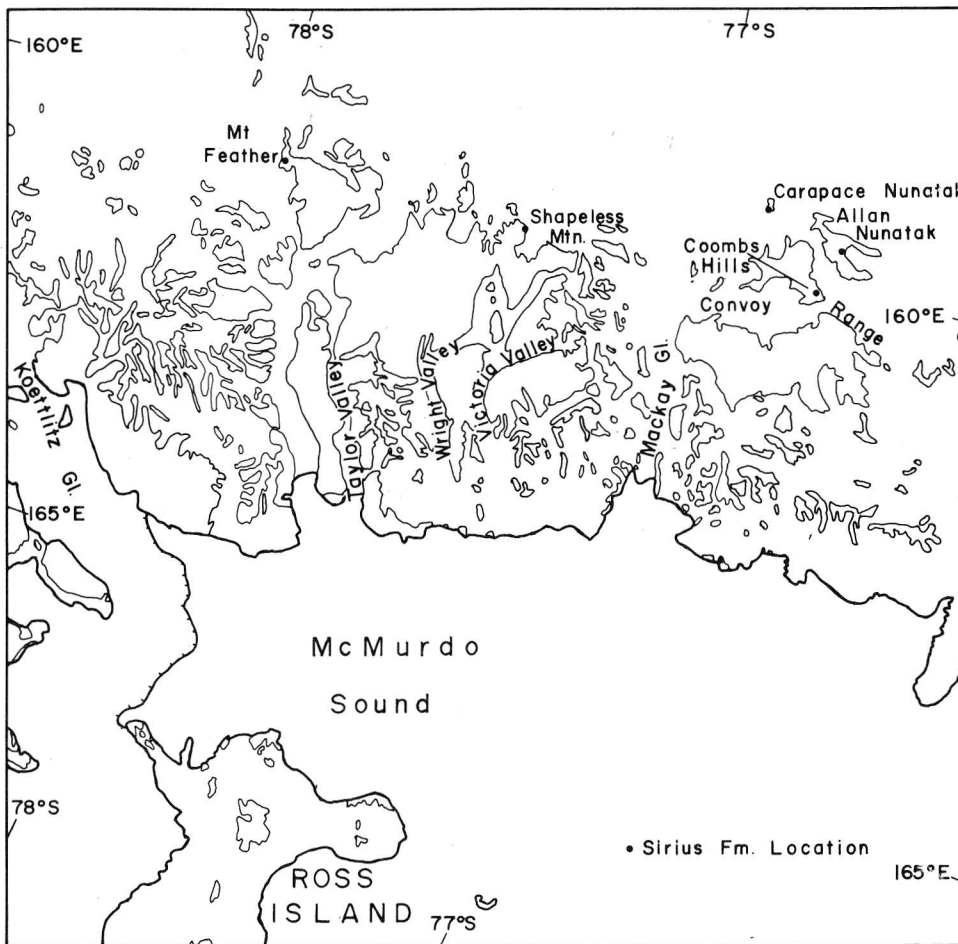


Figure 1 (left). Locations of the Sirius Formation in the McMurdo Sound region.

Figure 2 (right). Locations of the Sirius Formation in the central Transantarctic Mountains.

lenses. The Sirius Formation occurs stratigraphically below and topographically above the lateral moraines mentioned above, thus predating them.

The principal objective of the 1971-1972 season involved searching for a semilithified till equivalent to the Sirius Formation. In the central Transantarctic Mountains, the Sirius Formation is almost exclusively confined to elevations above 2000 meters. Corresponding areas above 2000 meters in the McMurdo region include the ice-free hills west of the valleys between Mount Feather and the Convoy Range. Five outcrops of semilithified till in this area (fig. 1 and table 1) were found that are believed to be equivalent to the Sirius Formation of the central Transantarctic Mountains (fig. 2 and table 2).

*Results of the 1970-1971 and 1971-1972 seasons.* In the central Transantarctic Mountains three systems of lateral moraines were differentiated by the degree of weathering of surficial boulders, by the degree of soil development (Everett and Behling, 1970) and by their elevations. These three moraine systems are called, from oldest to youngest, the high moraine, the middle moraine, and the low moraine.

This nomenclature holds in the areas of the Shackleton, Amundsen, and Scott Glaciers and can be extended to the lateral moraines of the adjacent Beardmore Glacier where they can be referred to formally, for example in the Beardmore Glacier, as the Beardmore High Moraine, the Beardmore Middle Moraine, and the Beardmore Low Moraine. A map of this area is being prepared.

The low moraines of the Shackleton, Amundsen, and Scott Glaciers include deposits up to 30 meters above the present ice surface. The profiles of the low moraines parallel present ice profiles. This system shows evidence of a minor readvance, in the form of a push moraine, 10 to 20 meters above the present ice surface.

Longitudinal profiles of the high and middle moraines (fig. 3) in the 1970-1971 study area imply synchronous and marked thickening of both the plateau ice at the heads of the glaciers and of the outlet glaciers themselves. The long profiles of the high and middle moraines roughly parallel present ice slopes from the heads of the glaciers to within 65 to 80 kilometers of the Ross Ice Shelf, but then flatten

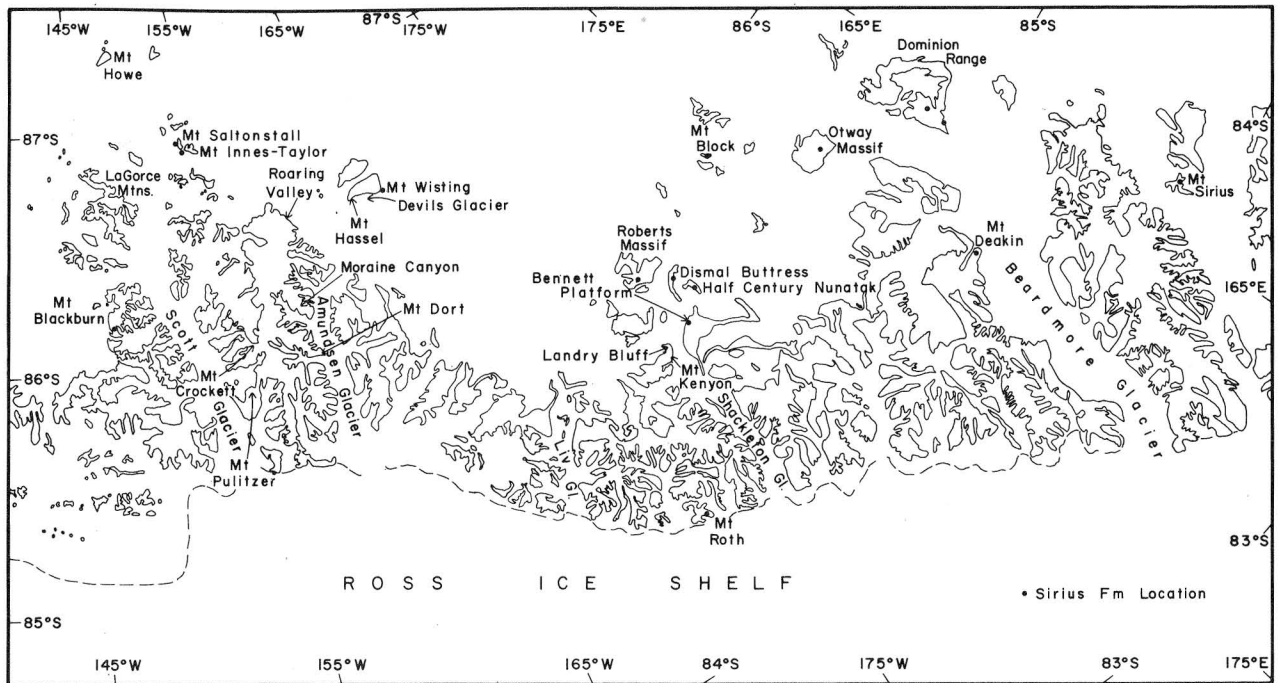


Table 1. Sites of the Sirius Formation in the McMurdo region.

Location (first observed by)	Elevation at top of deposit (meters)
†* Mt. Feather (D. Elliot, pers. comm.)	2,800
†* Shapeless Mts. (P. Barrett, pers. comm.)	2,400
†* Coombs Hills (P. Barrett, pers. comm.)	1,900
†*0 Carapace Nunatak (H. Borns and B. Hall, pers. comm.)	2,000
†* Allan Nunatak (H. Borns and B. Hall, pers. comm.)	1,750

Symbols for tables 1 and 2.

- \* site investigated by this author
- † sample obtained by this author
- 0 deposit not *in situ*
- ? deposit questionable
- B Beardmore Glacier area
- S Shackleton Glacier area
- A Amundsen Glacier area
- Sc Scott Glacier area

markedly toward the coast. The flattening may imply grounding of the Ross Ice Shelf, possibly as suggested by Hollin (1962). Thus, evidence suggesting that the Ross Ice Shelf was grounded exists in the McMurdo region (Nichols, 1961) and in the central Transantarctic Mountains. Further, the central Transantarctic Mountains provide evidence for the synchrony between the grounding effects noticed in the profiles of the lateral moraines and the thickenings of the plateau ice.

As mentioned above, the Sirius Formation was deposited before the lateral moraines were. In the central Transantarctic Mountains, the Sirius Formation

Table 2. Sites of the Sirius Formation in the central Transantarctic Mountains.

Location (first observed by)	Elevation at top of deposit (meters)	Area
†* Dominion Range (Oliver, 1964)	2,200	B
†* Otway Massif (D. Elliot, pers. comm.)	2,400	B
† Mount Sirius (Barrett, 1969)	2,300	B
† Mount Deakin (S. Etter and D. Coates, pers. comm.)	2,800	B
†* Mount Block (D. Elliot, pers. comm.)	2,700	B
†* Roberts Massif (Wade <i>et al.</i> , 1965)	2,100	S
* Dismal Buttress (Wade <i>et al.</i> , 1965)	2,300	S
? Half Century Nunatak	2,600	S
†* Bennett Platform (Wade <i>et al.</i> , 1965)	2,150	S
† Mount Roth (E. Stump and V. Wendland, pers. comm.)	800	S
0†* Mount Wisting	2,000	A
Mount Blackburn area (Doumani and Minschew, 1965)	3,000	Sc
0 Mount Saltonstall (Doumani and Minschew, 1965)	2,200	Sc
0 Mount Innes-Taylor (Doumani and Minschew, 1965)	2,200	Sc

consists of both a lower massive till and an upper assemblage of interlayered till and stratified lenses. Deposits of the Sirius Formation found in the McMurdo region contain only the lower massive till.

The lower massive till of the Sirius Formation is thought to be a basal till because of extremely strong fabric, high concentration of faceted and striated pebbles, and heterogeneous particle sizes (clay to boulders). Fabrics observed in the basal till indicate that the ice that deposited the Sirius Formation, although displaying a much higher surface than the

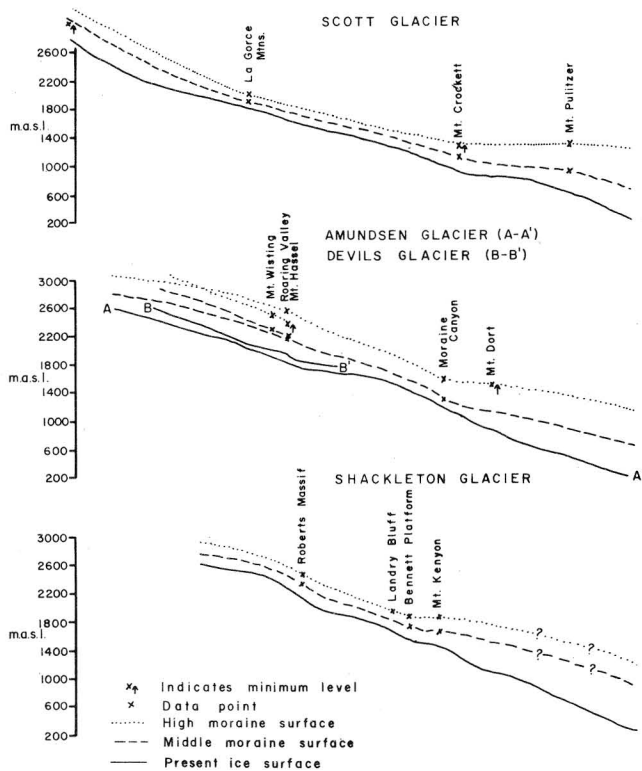


Figure 3. Profiles of middle and high moraines.

present ice, flowed in the same direction the present ice does. The broad expanse of depositional sites (Scott Glacier to the Coombs Hills) and the fabrics imply that the Sirius Formation was deposited by a continental-scale ice sheet. Moreover, to deposit a basal till the ice related to the Sirius Formation must have been not only of a continental scale but thick enough to permit basal melting.

Further investigation of samples collected will help elucidate the environment of deposition of the Sirius Formation.

This work was supported by National Science Foundation grant GV-26652.

I acknowledge the aid of the helicopter crews of VXE-6 in transporting a 400-kilogram cavernously weathered granite boulder from Bull Pass (adjacent to Wright Valley) to McMurdo Station. The boulder was shipped to Boston's Museum of Science to be put on display as part of an exhibit of interesting rocks from around the world.

#### References

Barrett, P. J. 1969. Stratigraphy and petrology of the mainly fluvial Permian and Triassic Beacon rocks, Beardmore Glacier area, Antarctica. *Institute of Polar Studies. Report*, 34. 132 p.

Elliot, D. H., and D. A. Coates. 1971. Geological investigations in the Queen Maud Mountains. *Antarctic Journal of the U.S.*, VI(4): 114-118.

Everett, K. R., and R. E. Behling. 1970. Chemical and physical characteristics of Meserve Glacier morainal soils, Wright Valley, Antarctica: an index of relative age? In: *International Symposium on Antarctic Glaciological Exploration, Hanover, New Hampshire, 3-7 September 1968. International Association of Scientific Hydrology. Publication*, 86. p. 459-460.

Doumani, G. A., and V. H. Minshew. 1965. General geology of the Mount Weaver area, Queen Maud Mountains, Antarctica. *Antarctic Research Series*, 6: 127-139.

Hollin, J. T. 1962. On the glacial history of Antarctica. *Journal of Glaciology*, 4(32): 173-195.

Mercer, J. H. In press. Some observations on the glacial geology of the Beardmore Glacier area. In: R. J. Adie (ed.), *Antarctic Geology and Geophysics*. Oslo, Universitetsforlaget.

Nichols, R. L. 1961. Multiple glaciation in the Wright Valley, McMurdo Sound, Antarctica. *Tenth Pacific Science Congress. Abstracts of Papers Presented*, p. 317.

Oliver, R. L. 1964. Geologic observations at Plunket Point, Beardmore Glacier. In: R. J. Adie (ed.) *Antarctic Geology*. New York, John Wiley & Sons, Inc. p. 248-258.

Wade, F. A., V. L. Yeats, J. R. Everett, D. W. Greenlee, K. E. LaPrade, and J. L. Shenk. 1965. Geology of the Central Queen Maud Range, Transantarctic Mountains, Antarctica. *Texas Tech University. Antarctic Series*, 65-1. 54 p.

## Mawson Tillite, Victoria Land, East Antarctica: reinvestigation continued

HAROLD W. BORNS, JR. and BRADFORD A. HALL  
*Department of Geological Sciences  
 University of Maine at Orono*

HAROLD W. BALL  
*Division of Paleontology  
 British Museum*

H. KELLEY BROOKS  
*Department of Geology  
 University of Florida*

This program was a continuation of the program to reinvestigate the origin and age of the Mawson Tillite(?) begun in the 1968-1969 field season by H. W. Borns, Jr., and B. A. Hall.

Our primary objective in the 1971-1972 season was to revisit a Jurassic pond deposit at Carapace Nunatak in the Transantarctic Mountains of south Victoria Land in a continuing effort to describe the fauna and flora and ascertain the paleoenvironment and age of this important Southern Hemisphere fossil locality (Borns and Hall, 1969; Hall and Borns, 1970).

The party was placed on Carapace Nunatak by helicopters in late December and during the 10 days that followed quarried approximately 700 kilograms of