

Beardmore Glacier References

General

Elliot, D.H., and Darrah, M., 1991, Beardmore Project, 1990-1991, *Antarctic Journal of the United States*, Vol. 26, No. 5, p. 1-2.

Abstract:

A description is given of 1990-1991 activities at Beardmore Base Camp. In addition to the science activities, summaries are given of the logistics that went into the setting up and operating of the base camp; helicopter operations for moving 29 scientists involved in eight projects and their equipment to and from McMurdo Station and to various field camps during this two-months investigative program. The science effort concentrated on aspects of the Gondwana sequence, structural evolution of the Transantarctic Mountains, and Late Cenozoic paleoclimate. Field investigations resulted in the acquisition of much new data, and a number of significant paleontological discoveries were made at several sites within about 50-60 km of the Beardmore Base Camp.

History

Jones, A.G.E., 1984, Shackleton's Ross Sea Party 1914-1917, *Fram: The Journal of Polar Studies*, Vol. 1, No. 2, p. 429-445.

Abstract:

For the Imperial Trans-Antarctic Expedition in 1914, Shackleton needed a party in the Ross Sea to prepare the way across the Barrier for him. He gave the command of the ship, the «Aurora,» to Captain A.L.A. Mackintosh. To lay the depots he asked Ernest Joyce. The task of the Ross Sea party was simple, but in the end everything went wrong. In the winter the ship drifted out, so that the shore party had to make do with second-hand equipment. Most of their sledge dogs were killed in the autumn sledging season. When three parties set out on the main journey, one had to return prematurely. The remaining six men were affected by scurvy. They had worse weather than any of the many parties who had followed the well-trodden path from Corner Camp to Mount Hope. The Ross Sea party demonstrated how the care shown to their dogs ultimately proved the difference between life and death when the men were hauling at an efficiency of about five percent. Without the help of their four dogs they may not have reached their depot and returned safely to Hut Point. (Auth. mod.)

Exploration (Mapping / Geology)

Cawley, R.W., 1960, Alpinists Explore New Land in Beardmore Glacier Area, *Antarctic*, Vol. 2, No. 5, p. 166-168.

Glaciology

Denton, G.H., Andersen, B.G., Conway, H.W., 1986, Late Quaternary Surface Fluctuations of Beardmore Glacier, Antarctica, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 90-92.

Abstract:

The Beardmore Glacier, because of its interior location and adjacent ice-free areas, is believed to be well suited to document antarctic ice sheet behavior during Quaternary time. During the 1985-86 austral field season glacial drift sheets were mapped to resolve conflicting interpretations of late Quaternary surface-level changes of Beardmore Glacier. From Beardmore lateral moraines, Mercer (1972) inferred extensive grounding of the Ross Ice Shelf accompanied by little or no change in interior East Antarctica during the late Quaternary ice ages. In sharp contrast, Mayewski (1975) concluded that the lateral moraines reflect former thickening of east antarctic ice accompanied by only minor grounding-line advance along the inland periphery of the Ross Ice Shelf. The inferences concerning late quaternary drift sheets drawn from the present study are in substantial agreement with those of Mercer (1972).

Denton, G.H., Bockheim, J.G., Wilson, S.C., Leide, J.E., 1989, Late Quaternary Ice-Surface Fluctuation of the Beardmore Glacier, Transantarctic Mountains, *Quaternary Research*, Vol. 31, No. 2, p. 183-209.

Abstract:

Former longitudinal profiles of Beardmore Glacier, an outlet through the Transantarctic Mountains, constrain polar plateau elevation near the center of Antarctica and ice-shelf grounding in the southern Ross Embayment. Three gravel drift sheets of late Quaternary age occur alongside Beardmore Glacier. From correlation with numerically dated drifts farther north, an early Holocene age is assigned to Plunket drift, a late Wisconsin age to Beardmore drift, and an age of marine isotope Stage 6 to Meyer drift. By this age model, Beardmore Glacier was close to current elevations in its upper reaches and thickened considerably in its middle and lower reaches during the last two global glaciations represented by Beardmore and Meyer drifts. Most likely, grounded ice in the southern Ross Embayment caused such thickening of Beardmore Glacier almost to the polar plateau. A concomitant decline in precipitation is implied by ice-cap retreat on the nearby Dominion Range and is consistent with little change of upper Beardmore Glacier. Ice-shelf grounding most likely resulted from lowered sea level and/or basal melting. Lower than present precipitation was probably caused by colder air temperatures and more-distant open water. The Plunket profile records Holocene ice-surface lowering from increased surface ablation, decreased ice flow, or grounding-line recession. (Auth. mod.)

Mayewski, P.A., 1975, Glacial Geology and Late Cenozoic History of the Transantarctic Mountains, Antarctica, *Institute of Polar Studies, Report No. 56*, Columbus, Ohio State University, 215 p.

Mayewski, P.A., 1986, Dominion Range Ice Core, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 120-121.

Abstract:

Ice core studies conducted during the 1984-1985 austral summer in the Dominion Range gave the following results: development of ultra-clean firn/ice processing techniques for both field and laboratory; a map of ice-surface elevations and ice thicknesses in the drill site area; physical measurement on the core including stratigraphy and thin-section analysis; and analysis of all surface and snowpit samples and selected sections of core for sulfate, nitrate, chloride, fluoride, sodium, reactive silicate, and total beta-activity and oxygen isotopes.

Mayewski, P.A., 1987, Transantarctic Mountains Ice Core Study, *Antarctic Journal of the United States*, Vol. 22, No. 5, p. 78.

Abstract:

A 201 m core was retrieved from a 2,800 m high snow massif atop Dominion Range for study to obtain information on climate change and atmospheric chemistry. Chemical properties, physical properties, and oxygen isotope analysis are currently being completed on a 6 m snowpit, several 2 m snowpits, fresh and aged surface snow, and the 201 m core.

Mayewski, P.A., and Goldthwait, R.P., 1985, Glacial Events in the Transantarctic Mountains: A Record of the East Antarctic Ice Sheet, *Geology of the Central Transantarctic Mountains, Antarctic Research Series*, Vol. 36, p. 275-324.

Mayewski, P.A., Twickler, M.S., Lyons, W.B., Spencer, M.J., Meese, D.A., Gow, A.J., Grootes, P., Sowers, T., Watson, M.S., Saltzman, E., 1990, The Dominion Range Ice Core, Queen Maud Mountains, Antarctica-General Site and Core Characteristics with Implications, *Journal of Glaciology*, Vol. 36, No. 122, p. 11-16.

Abstract:

The Transantarctic Mountains of East Antarctica provide a new milieu for retrieval of ice-core records. Here are reported the initial findings from the first of these records, the Dominion Range ice-core record. Sites such as the Dominion Range are valuable for the recovery of records detailing climate change, volcanic activity, and changes in the chemistry of the atmosphere. The unique geographic location of this site and a relatively low accumulation rate combine to provide a relatively long record of change for this potentially sensitive climatic region. As such, information concerning the site and general core characteristics are presented, including ice surface, ice thickness, bore-hole temperature, mean annual net accumulation, crystal size, crystal fabric, oxygen-isotope composition, and examples of ice chemistry and isotopic composition of trapped gases. (Auth.)

Mellor, M., and Swithinbank, C., 1989, Airfield on Antarctic Glacier Ice, *CRREL*, Report 89-21, December, 1989, p. 11-37.

Mercer, J.H., 1986, Southernmost Chile: A Modern Analog of the Southern Shores of the Ross Embayment During Pliocene Warm Intervals, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 103-105.

Abstract:

Plant remains, including wood have been found at Oliver Bluffs, Dominion Range massif, Beardmore Glacier area at 85 deg lat., 1,800-m elevation in thin, organic-rich bands interbedded at several horizons with glacial, glaciofluvial, and glaciolacustrine sediments. The presence of small wood fragments, some of them coniferous, is evidence that tree or woody-shrub species were present on the slopes of the Transantarctic Mountains facing the Ross Embayment. This implies that summer air temperatures were well above freezing, probably no lower than 5 deg C. Because the Antarctica/South America land bridge was the last connection of Antarctica to the outside world to have been broken, the closest modern analogs of Neogene antarctic vegetation are likely to be in southernmost South America. The western slopes of the southern Andes are very wet and comparable conditions are unlikely to have prevailed on the Ross Embayment slopes during the Neogene warm intervals. However, if the species of conifer or conifers that were present at Oliver Bluffs were closely related to the modern southernmost conifers «*Pilgerodendron uvifera*» and «*Dacrydium fonckii*,» rainfall is likely to have been at least moderate as in Pisano's (1977, p.219) «*Pilgerodendro-Sphagnetum magellanicum*» sub-association, in the drier parts of the islands south of the Beagle Channel. Thus the environment of the Ross Embayment coasts at a time of Pliocene warmth may, as regards ice cover, have resembled the extremely wet fjord region of Patagonia and Tierra del Fuego, whereas the vegetation cover more closely resembled that of drier areas on the other side of the main divide.

Mercer, J.H., 1972, Some Observations on the Glacial Geology of the Beardmore Glacier Area, *Antarctic Geology and Geophysics, Symposium on Antarctic Geology and Solid Earth Geophysics, Oslo, 6-15 August, 1970*, R.J. Adie, p. 427-433.

Prentice, M.L., 1986, Pre-late Quaternary Glaciation of the Beardmore Glacier Region, Antarctica, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 95-98.

Abstract:

During the 1985-86 austral field season, studies were conducted in the Beardmore Glacier region to test hypotheses for pre-late Quaternary glaciation. Exposed highlands were examined from the Dominion Range north to the Queen Elizabeth Range. The glacial deposits, which include the Sirius Formation, are referred to as Sirius drift and Dominion drift. The character of the Sirius drift suggests a long interval of temperate glaciation during which thick continental ice with a thawed bed completely overrode the mountains of the Beardmore region. The results also suggest that Dominion drift was deposited by ice with a frozen bed under a polar climate similar to today's. The Beardmore region provides the strongest evidence to date supporting the hypothesis of Denton et al, 1984, for complete overriding of the Transantarctic Mountains by thick continental ice in pre-late Quaternary time.

Geomorphology

Barrett, P.J., 1970, Paleocurrent Analysis of the Mainly Fluvial Permian and Triassic Beacon Rocks, Beardmore Glacier area, Antarctica, *Journal of Sedimentary Petrology*, Vol. 40, No. 1, p. 395-411.

Abstract:

The postglacial Beacon sequence in the Beardmore Glacier area comprises 2000 m of nonmarine clastic sediments. Approximately 3000 paleocurrent measurements were taken in sets of about six from stratigraphic intervals less than 30 m thick from the Mackellar, Fairchild, and Buckley Formations of Permian age and the Gremouw and Falla Formations of Triassic age. These data yielded 432 current directions, 168 from small-scale cross-bedding, 162 from medium-scale cross-bedding, 69 from parting lineation, and 33 from logs, ripple marks, and slump folds.

Analysis of variance, using vector rather than arithmetic means, was used to indicate the likelihood that differences in current direction for different areas, formations, or types of sedimentary structures are due to variations in a normally distributed population.

Four formations have essentially a unimodal current pattern, while the Buckley Formation has a centripetal pattern. There is no significant difference (F.30) between mean directions to the southeast for the three Permian formations, or to the northwest for the two Triassic formations. This reversal implies a laterally constraint of both Permian and Triassic paleocurrent systems.

Mean current directions for small- and medium-scale cross-bedding and parting lineation within each formation are not significantly different, and for the Fairchild and Buckley Formations, values for standard deviation are also similar. For these two units, each structure is an equally reliable indicator of paleocurrent direction, and a hierarchy of bedforms like that proposed by Allen (1966) is not indicated. However, such a hierarchy might exist for the Fremouw Formation, where parting lineation is significantly less variable than medium-scale cross-bedding, and medium-scale cross-bedding is significantly less variable than small-scale cross-bedding.

Geology

Barrett, P.J., 1972, Stratigraphy and Petrology of the mainly Fluvial Permian and Triassic Part of the Beacon Supergroup, Beardmore Glacier Area, *Antarctic Geology and Geophysics, Symposium on Antarctic Geology and Solid Earth Geophysics, Oslo, 6-15 August 1970, R.J., Adie*, p. 365-372.

Barrett, P.J., and Elliot, D.H., 1972, The Early Mesozoic Volcaniclastic Prebble Formation, Beardmore Glacier Area, *Antarctic Geology and Geophysics, Symposium on Antarctic Geology and Solid Earth Geophysics, Oslo, 6-15 August 1970, R.J., Adie*, p. 403-409.

Barrett, P.J., Elliot, D.H., Lindsey, J. F., 1986, Beacon Supergroup (Devonian-Triassic) and Ferrar Group (Jurassic) in the Beardmore Glacier Area, Antarctica, *Antarctic Research Series*, Vol. 36, No. 4, p. 339-428.

Abstract:

The detailed stratigraphic data from the Beardmore Glacier area, presented here in tables, diagrams, cross sections and text, include the Taylor Group (Permian) with the Pagoda, Mackellar, Fairchild and Buckley formations, the Victoria Group (Triassic) with the Fremouw, Falla and Prebble formations and the Ferrar Group (Jurassic). Metamorphism in the Beacon Supergroup and the geological history of the Beardmore Glacier area from the Devonian to the Jurassic are discussed. A type section of the Kirkpatrick Basalt, Mount Falla is appended. The stratigraphic nomenclature and methods of data collection and treatment are explained.

Borg, S.G., Goodge, J.W., DePaolo, D.J., Mattinson, J.M., 1986, Field Studies of Granites and Metamorphic Rocks: Central Transantarctic Mountains, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 43-45.

Abstract:

Field studies of the late Precambrian to early Paleozoic basement of the central Transantarctic Mountains conducted during the 1985-1986 season are summarized. Reconnaissance mapping and sampling were conducted in the segment of the range between the Nimrod and Good glaciers. In addition several areas were mapped in detail, including the Campbell Hills and Cape Lyttelton area, the Mount Hope and Cape Allen area, and a portion of the western side of the Miller Range. It was concluded that (1) the Endurance thrust of Grindley (1972) is in fact a distributed shear zone which displaced high-grade rocks of the Miller Formation to the southeast over other (younger?) rocks originally designated as part of the Nimrod Group; (2) rocks of the Miller Formation may not be equivalent to other geologic units assigned to the Nimrod Group; (3) the Aurora Formation augen gneiss is better characterized as a mylonitic gneiss derived from granodiorite; and (4) the mylonite zone described here is offset by a number of high-angle faults but is nowhere tightly folded as suggested of the Endurance thrust by Grindley (1972).

Briden, J.C., and Oliver, R.L., 1963, Paleomagnetic Results from the Beardmore Glacier Region, Antarctica, *New Zealand Journal of Geology and Geophysics*, Vol. 6, No. 3, p. 388-394.

Collinson, J.W., and Miller, M.F., 1988, Sedimentologic Comparison of Permian Post-glacial Black Shale Sequences in the Ellsworth Mountains and the Beardmore Glacier Region, *Antarctic Journal of the United States*, Vol. 23, No. 5, p. 5-7.

Abstract:

Lower Permian post-glacial black shales in the Ellsworth Mountains and Beardmore Glacier region accumulated in an extensive inland sea. Significant differences in this unit across the region provide important clues toward interpreting paleogeography. Comparing the Polarstar Formation in the Ellsworth Mountains with its counterpart, the Mackellar Formation, in the central Transantarctic Mountains: thicknesses are 5 to 10 times greater, 6-10 major coarsening-upward cycles occur compared to 1-3 cycles, individual beds within coarsening-upward cycles coarsen rather than fine upward, trace fossils suggest marine rather than fresh-water conditions, the deltaic to fluvial facies transition is gradual rather than abrupt, and coal measures rather than non-carbonaceous fluvial beds lie immediately above. The significance of these differences is explained and processes involved making the differences are identified.

Elliot, D.H., Larsen, D., 1993, Mesozoic Volcanism in the Central Transantarctic Mountains, Antarctica: Depositional Environment and Tectonic Setting, *Proceedings of the Eight Gondwana Symposium, Hobart, Tasmania, Australia, 21-24 June, 1991*, p. 397-410.

Fitzgerald, P.G., 1986, Fission Track Tectonics of the Transantarctic Mountains, Beardmore Glacier Area, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 38-41.

Abstract:

The main field objective of this project was to collect samples for fission-track analysis to determine the timing and rate of uplift of the Transantarctic Mountains and measure relative vertical displacements across faults within the range. As part of the 1985-1986 Beardmore Glacier field camp, two general areas were selected for study: the coastal region around the mouth of the Beardmore Glacier and further inland in the Miller and Queen Elizabeth Ranges. Fieldwork was done on foot from two helicopter-supported satellite camps as well as by close support on day trips out of Beardmore camp during the period from Nov. 23, to Dec. 16, 1985. Sampling was limited to rocks containing apatite. The results from southern Victoria Land (Fitzgerald and Gleadow, 1985) show a strong correlation between apatite age and sample elevation and indicate a two-stage uplift history for the Transantarctic Mountains. A table of these results is presented.

Grindley, G.W., 1963, The Geology of the Queen Alexandra Range, Beardmore Glacier, Ross Dependency, Antarctica; with notes on the correlation of the Gondwana sequences, *New Zealand Journal of Geology and Geophysics*, Vol. 6, No. 3, p. 307-347.

Grindley, G.W., McGregor, V.R., Walcott, R.I., 1964, Outline of the Geology of the Nimrod-Beardmore-Axel Heiberg Glaciers Region, Ross Dependency, *Antarctic Geology, Proceedings of the first International Symposium on Antarctic Geology, held in Cape Town 16-21 September 1963*, p. 206-219.

Gunner, J.D., 1982, Basement Geology of the Beardmore Glacier Region, *Geology of the Central Transantarctic Mountains, Antarctic Research Series*, Vol. 36, p. 1-9.

Horner, T.C., and Krissek, L.A., 1992, Statistical Analysis of Geochemical Patterns in Fine-Grained Permian Mudrocks from the Beardmore Glacier Region, Antarctica, *Recent Progress in Antarctic Earth Science, Proceedings of the Sixth International Symposium on Antarctic Earth Sciences, Ranzan, Saitama, Japan, September 9-13, 1991*, p. 241-248.

Horner, T.C., and Krissek, L.A., 1991, Contribution of Sedimentologic, Thermal Alteration, and Organic Carbon Data to Paleoenvironmental Interpretation of Fine-Grained Permian Clastics from the Beardmore Glacier Region, Antarctica, *Contribution to Antarctic Research II, Antarctic Research Series, Volume 53*, p. 33-65.

Mabin, M.C.G., 1986, Sirius Formation Basal Contacts in the Beardmore Glacier Region, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 32-33.

Abstract:

During the 1985-86 season the disconformity between the basal Sirius Formation and underlying rocks was examined at 5 localities: Mt. Sirius, Dominion Range, Plunket Point, The Cloudmaker, and Orr Peak. The basal contacts of the Sirius Formation described range from those showing extensive glacial erosion to surfaces largely unmodified by overriding ice. They range in elevation through some 1,500 m, and indicate glaciation of a relatively high-relief landscape in a configuration similar to the present day. It is also likely that they are of different ages, and some may have been formed during several different ice advances prior to the commencement of deposition of the Sirius Formation.

McGregor, V.R., 1965, Notes on the Geology of the Area Between the heads of the Beardmore and Shackleton Glaciers, Antarctica, *New Zealand Journal of Geology and Geophysics*, 8(2), p.278-291.

Abstract:

Four stratigraphic columns from the upper part of the Beacon Group near the Mill and Keltie Glaciers are presented. The oldest formation examined, the Buckley Coal Measures, contains a good *Glossopteris* flora. Well developed cyclothem in the overlying Falla Formation are considered to reflect deposition under arid conditions by rivers whose courses shifted over a slowly subsiding flood plain. The Falla Formation is overlain by the Dominion Coal Measures, whose type section is described. Middle or Upper Triassic Plants found in an erratic boulder at the head of the Mill Glacier may have come from the Dominion Coal Measures. These formations of the Beacon Group are overlain by tholeiitic flood basalts of the Kirkpatrick Basalt and are intruded by comagmatic Ferrar Dolerite. The occurrence of secondary minerals, including zeolites, in the basalts is briefly discussed. A compact till containing dolerite boulders, which crops out on the edge of the Polar Plateau at the head of the Shackleton Glacier, is compared with tillite found recently by Oliver near Plunket Point, at the head of the Beardmore Glacier. Both are considered to be Quaternary. (Auth.)

Barrett P.J. 1965. Geology of the area between the Axel Heiberg and Shackleton Glaciers, Queen Maud Range, Antarctica. *New Zealand Journal of Geology and Geophysics* 8: 344-70.

McKelvey, B.C., Webb, P.N., Harwood, D.M., Mabin, M.C.G., 1991, Dominion Range Sirius Group: A Record of the Late Pliocene-early Pleistocene Beardmore Glacier, *Geological Evolution of Antarctica; proceedings of the Fifth International Symposium on Antarctic Earth Sciences, Cambridge, 1987*, M.R.A. Thomson, J.A. Crame, J.W. Thomson (ed), Cambridge University Press, Cambridge, p. 675-682.

Abstract:

On Oliver Platform in the Dominion Range, late Pliocene and/or early Pleistocene Sirius Group strata include the 185 m thick Meyer Desert Formation, composed predominantly of semi-lithified fossil-bearing coarse lodgement tillites and minor fluvioglacial and glaciolacustrine deposits. Fossils include «in situ *Nothofagus*» fragments, palynomorphs, and a variety of Cenozoic marine microfossils reworked from the Pensacola subglacial basin of East Antarctica. Approximately 6 km farther west a 50 m thick section of the younger Mount Mills Formation of the Sirius Group consists of coarse fluvioglacial diamictites, conglomerates and breccias. The Meyer Desert Formation rests disconformably via the glacially cut Dominion Erosion Surface on Mesozoic strata at between 1800 m and 2650 m above sea level. This altitude range reflects original relief on the uplifted erosion surface. The latter is a composite one representing at least two separate phases of cutting separated by uplift. Consequently the mantling Meyer Desert Formation records two (or more) separate periods of deposition, and the sequence has been subsequently uplifted more than 1300 m. The Dominion Range Sirius Group is interpreted as the uplifted late Pliocene and/or early Pleistocene record of Beardmore Glacier, then flowing at an approximately 1300 m lower altitude. The Sirius Group strata and the fossil plants indicate a much more temperate setting than at present, with temperatures being in the order of 15-20 C warmer.

Miller, J.M.G., and Waugh, 1986, Sedimentology of the Pagoda Formation (Permian), Beardmore Glacier Area, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 45-46.

Oliver, 1972, Geology of an Area near the Mouth of Beardmore Glacier, Ross Dependency, *Antarctic Geology and Geophysics, Symposium on Antarctic Geology and Solid Earth Geophysics, Oslo, 6-15 August 1970*, R.J. Adie (ed), p. 379-386.

Oliver, R.L., 1964, The Level of Former Glaciation near the Mouth of Beardmore Glacier, *Antarctic Geology, Proceedings of the first International Symposium on Antarctic Geology, held in Cape Town 16-21 September 1963*, p. 138-142.

Oliver, R.L., 1964, Geological Observations at Plunket Point, Beardmore Glacier, *Antarctic Geology, Proceedings of the first International Symposium on Antarctic Geology, held in Cape Town 16-21 September 1963*, p. 248-258.

Tasch, P., 1982, Experimental Valve Geothermometry Applied to Fossil Conchostracan Valves, Blizzard Heights, Antarctica, *International Union of Geological Sciences, Publication. Series B, No.4, Antarctic geoscience: Symposium on Antarctic Geology and Geophysics, University of Wisconsin, Aug. 1977*, C. Craddock (ed.), Madison, University of Wisconsin Press, p. 661-668.

Abstract:

Conchostracan-bearing samples collected from Jurassic interbeds between two basalt flows (Blizzard Heights, Marshall Mountains) displayed various valve conditions. These variations were apparently related to thermal events generated by the overlying basalt flow. As a follow up, experimental data were obtained from furnace heating valves of a living conchostracan that has Paleozoic and Mesozoic equivalents. Dried cyziclid valves in either a naked state or embedded in tri-layered clay mud briquettes, were exposed to temperatures of 200 C-1200 C. Thermally-induced color class and/or other valve changes were observed. Experimental temperature ranges were established for each class. Occurrence of more than one color class or other valve change can be attributed to a differential thermal effect on the surficial compared to the underlying cuticle(s). (Auth. mod.)

Webb, P.N., 1987, Sirius Formation of the Beardmore Glacier Region, *Antarctic Journal of the United States*, Vol. 22, No. 1-2, p. 8-13.

Abstract:

During Nov. and Dec. 1985, outcrops of the Sirius Formation in the Miller, Queen Alexandra (The Cloudmaker), and Dominion ranges and on Mount Sirius were examined. Deposits in the Miller Range and at The Cloudmaker were not previously known. This report provides a brief review of preliminary data on Sirius Formation stratigraphy, sedimentation, and glacial history in the central Transantarctic Mountains. (Auth.)

Young, D.J., and Ryburn, R.J., 1968, The Geology of Buckley and Darwin Nunataks, Beardmore Glacier, Ross Dependency, Antarctica, *New Zealand Journal of Geology and Geophysics*, Vol. 11, No. 4, p. 922-939.

Abstract:

The geology of the Buckley and **Darwin** Nunataks at the head of the Beardmore **Glacier**, Ross Dependency, Antarctica, is described. Cambrian Archaecyathid-bearing Shackleton Limestone is unconformably overlain by about 300 ft of hard pinkish white quartz sandstone with occasional beds of greenish grey and dark grey micaceous siltstone of the Alexandra Formation. This in turn is conformably overlain by about 400 ft of very well bedded fissile mudstone and siltstone of the McKellar Formation. About 2,000 ft of sandstone and siltstone, and upper beds of which contain plentiful plant fossils of the Permian genus *Glossopteris*, overlies the McKellar Formation and can be subdivided and correlated with the Lower and Middle Buckley Coal Measures. Intrusions of Ferrar Dolerite are common and 13 representative specimens have been described.

Meteorites

Cassidy, W.A., 1992, 1985-1986 and 1986-1987 Field Seasons, Field and Laboratory Investigations of Antarctic Meteorites Collected by United States Expeditions 1985-1987, *Smithsonian Contributions to the Earth Sciences*, No. 30, U.B. Marvin and G.J. MacPherson (ed.), p. 11-16.

Abstract:

A brief summary is given of the collecting activities in the vicinity of Reckling Peak, Allan Hills, and Beardmore Glacier in the 1985-1986 season and at Lewis Cliff in the 1987 season. Insights are reported as to how and when teams traveled to the various camps where collections were made, their success at adding to the total of meteorites found, the state of the "Hard Times" camp near Coalsack Bluff, and the food cache found there.

Hagen, E.H., Koeberl, C., Faure, G., 1990, Extraterrestrial Spherules in Glacial Sediment, Beardmore Glacier Area, Transantarctic Mountains, *Contribution to Antarctic Research I. Antarctic Research Series*, Vol. 50, P. 19-24.

Pedology

Retallack, G.J., and Krull, E.S., 1998, Neogene Paleosols of the Sirius Group, Dominion Range, Antarctica, *Antarctic Journal of the United States*, Vol. 32, No. 5, p. 10-13.

Abstract:

The age and paleoclimate of fossils in the Sirius Group of the central Transantarctic Mountains is discussed. Some scientists believe that its fossil plants and diatoms are evidence of a major warming (5-10°C) and recession of the East Antarctic ice some 3 million years ago, and others find more compelling evidence elsewhere for stability of East Antarctic ice and warming of no more than 3°C and so regard the diatoms as surface contaminants or the Sirius Group as geologically older than 3 million years. Observations were made in the Sirius Group exposed from Meyer Desert down to Oliver Bluff with three distinctly different pedotypes. The Siesta pedotype occurred on a spur at the northeast edge of Oliver Bluff in the sequence of the lower Oliver Platform. This Paleosol of the Sirius Group in the Dominion Range is neither evidence for extreme warming and deglaciation nor for glaciers the same size as now but for an intermediate position of warmer and wetter climates than present. A Pliocene age for *Nothofagus* leaves in the Sirius Group would not be anomalous in this case.

Biology

Terrestrial Biology

Flora

Askin, R.A., and Markgraf, V., 1986, Palynomorphs from the Sirius Formation, Dominion Range, Antarctica, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 34-35.

Abstract:

A low-diversity assemblage of fossil palynomorphs has been recovered from the Sirius Formation in the Dominion Range. The dominant type of palynomorph comprises smooth, thin-walled bodies, some differentially thickened, which are believed to be algal in origin. Some of the nondescript palynomorphs may be fungal. Specimens recovered include «*Nothofagus*» (*fusca* group) pollen grains; a thick-walled microreticulate tricolp(or)ate to tetracolp(or)ate angiosperm pollen species (?*Polygonaceae/Labiatae*); rare podocarpaceous conifer pollen «(?*Dacrydium*);» rare indeterminate angiosperm pollen; and rare palynomorphs of uncertain origin. The presumed in-place palynomorphs, together with other plant material, reflect an extremely species-poor and probably specialized flora which survived in the Transantarctic Mountains until the Late Pliocene. The presence of paleosols with root remains, plus foliage and abundant wood, support the contention that at least some of the

palynomorphs were produced by plants growing while these Pliocene periglacial/interglacial lacustrine and fluvial sediments were accumulating.

Hill, R.S., Harwood, D.M., Webb, P.N., 1996, «*Nothofagus beardmorensis*» (Nothofagaceae), A New Species Based on Leaves from the Pliocene Sirius Group, Transantarctic Mountains, Antarctica, *Review of Palaeobotany and Palynology*, Vol. 94, No. 1-2, p. 11-24.

Abstract:

Leaves from the Late Pliocene Sirius Group at Oliver Bluffs in the Dominion Range are assigned to the new species «*Nothofagus beardmorensis*» Hill, Harwood et Webb, n.sp. The plant which produced the leaves was winter deciduous, and it is probable that the wood and pollen of «*Nothofagus*» that co-occur in the sediments are conspecific with «*N. beardmorensis*.» The presence of this species in Antarctica in the Pliocene suggests a much different climate than at present, since no extant «*Nothofagus*» species can survive temperatures below about -22°C in winter, and temperatures must have been substantially above 0°C for a relatively long period during the growing season for the growth and reproductive effort observed. A preliminary estimate of a 13-15°C temperature difference between fossil deposition and the present day is inferred. (Auth.)

Klavins, S.D., Taylor, E.L., Krings, M., Taylor, T.N., 2001, An Unusual, Structurally Preserved Ovule from the Permian of Antarctica, *Review of Palaeobotany and Palynology*, Vol. 115, No. 3-4, p. 107-117.

Abstract:

Anatomically preserved ovules are described from silicified peat of Late Permian age collected from Skaar Ridge in the central Transantarctic Mountains, Antarctica. The small ovules are significant in possessing fleshy apical appendages and a funnel-shaped micropylar extension formed by the sarcotestal layer of the integument, by which they differ from all other Permian ovules described to date. The apical modifications may have functioned in pollination and/or seed dispersal. Similarity with the apical organization of earlier Paleozoic ovules is shown to be superficial, since the analogous structures are developmentally derived from different tissues. Although the ovules occur in rocks in which glossopterids are the only gymnosperms represented, there is insufficient evidence to assign them to a taxonomic group. These ovules are of particular importance because there are so few anatomically preserved gymnosperm reproductive structures known from the Permian and thus provide new data on the diversity of late Paleozoic gymnosperms.

Townrow, J.A., 1966, Fossil Plants from Allan and Carapace Nunataks, and from the Upper Mill and Shakleton Glaciers, Antarctica, *New Zealand Journal of Geology and Geophysics*, Vol. 10, No. 2, p. 456-473.

Tyndale-Biscoe, C.H., 1960, On the Occurrence of Life near the Beardmore Glacier, Antarctica, *Pacific Insects*, Vol. 2, No. 2, p. 251-253.

Fauna

Ashworth, A.C., and Kuschel, G., 2003, Fossil Weevils (Coleoptera, Curculionidae) from Latitude 85°S Antarctica, *Palaeogeography, Palaeoclimatology, Palaeoecology*, Vol. 191, No. 2, p. 191-202.

Abstract:

Two species of fossil listroderine weevils (Coleoptera: Curculionidae: Rhytirhinini: Listroderina) are reported from the Meyer Desert Formation at a locality on the Beardmore Glacier in the Transantarctic Mountains about 500 km from the South Pole. Associated fossils include wood, leaves and pollen of *Nothofagus*, stems and leaves of several species of mosses, achenes of *Ranunculus*, shells of freshwater molluscs and a fish tooth. The age of the fossiliferous strata is contentious but probably within the range of Pliocene to mid-Miocene. The fossils represent organisms that colonised the margins of a glacier at the head of a fjord during an interglaciation. The autecology of the listroderine species indicates that temperatures during summer months averaged 5°C. The mean annual temperature, with winter temperatures constrained by 6 months of darkness, is estimated to have been about -8°C compared to the -26°C estimated for sea level at latitude 85°S today. The closest evolutionary link of the fossil listroderines is with South American rather than Australian or New Zealand taxa. Divergence

of the taxa, at least at the level of tribe, had most probably occurred on Gondwana before the continent broke apart. The fossil species are considered to be the descendants of Antarctic lineages which evolved on the continent in the Late Cretaceous or Palaeogene and survived until the Neogene. Extinction of the listroderines and most other Antarctic terrestrial biota occurred with the growth of the polar ice sheets and the change to the polar desert climate.

Colbert, E.H., 1982, Triassic Vertebrates in the Transantarctic Mountains, *Geology of the Central Transantarctic Mountains, Antarctic Research Series*, Vol. 36, p. 11-35.

Hill, D., 1964, Archaeocyatha from Loose Material at Plunket Point at the Head of Beardmore Glacier, *Antarctic Geology, Proceedings of the first International Symposium on Antarctic Geology, held in Cape Town 16-21 September 1963*, p. 609-622.

Krissek, L.A., Horner, T.C., Elliot, D.H., Collinson, J.W., 1992, Stratigraphy and Sedimentology of Vertebrate Bone-Bearing Beds in the Triassic (and Jurassic?) Fremouw and Falla Formations, Beardmore Glacier Region, Antarctica, *Redent Progress in Antarctic Earth Science, Proceedings of the Sixth International Symposium on Antarctic Earth Sciences, Ranzan, Saitama, Japan, September 9-13, 1991*, p. 249-256.

Pryor, M.E., 1964, Present Status of Soil Arthropod Surveys in Antarctica, *Geological Society of America, Special Paper*, No. 76, p. 315.

Abstract:

About 30 free-living and 28 ectoparasitic species of arthropods have been found in Antarctica. Although most species have been found in coastal areas, two new species of Collembola and a new family of trombidiform mites have been collected in the Hood Glacier area near 83°55'S. These finds constitute the southernmost known records for permanent free-living animal inhabitants. Investigations in those coastal areas of West Antarctica where a free-living arthropod fauna is represented show that mites and collembolans are usually found in areas of rubble accumulation with or without visible macrophytic vegetation. Arthropods are found also in areas of continuous or discontinuous macrophytic vegetation composed of mosses, lichens, and infrequent algal covers; but they are not abundant, and dominant organisms belong to the groups Protozoa, Nematoda, and Rotifera. The source(s) of the present free-living arthropod fauna is still unknown. Data gathered in south Victoria Land suggest that at least two species of Collembola have been in that area since the time of their speciation. Although results of aerial trapping have not proved dispersal from surrounding continents, they do show that insect dispersal by wind within the continent is a frequent occurrence. It has been suggested that the present free-living arthropod fauna may represent both relics from an ancient temperate fauna and post-Pleistocene immigrants from other continents or sub-Antarctic islands. (Auth., mod.)

Atmospheric

Climate

Grootes, P.M., Stuiver, M., Saling, T.L., Mayewski, P.A., Spencer, M.J., Alley, R.B., Jenssen, D., 1990, 1400-Year Oxygen Isotope History from the Ross Sea Area, *Annals of Glaciology*, Vol. 14, p. 94-98.

Abstract:

Four ice cores from the Ross Sea drainage show patterns of delta O-18 variations on a time scale of decades to centuries over the last 1400 years without change in the long-term average delta O-18. Century scale delta O-18 fluctuations in the two cores drilled in the Ross Ice Shelf at Station J-9 are highly correlated. The long isotope record (>30,000 a) of the 1978 J-9 core thus represents local conditions over at least 100 m and on time scales of 100 years and longer. Regional correlations between the J-9 delta O-18 records, and those from Ridge BC and the Dominion Range, are barely significant or absent. The failure to find clear regional isotope trends related to climate fluctuations may reflect the finding that between 1957 and 1982 the area was in the transition zone between areas with opposite temperature trends, and showed little or no temperature change. The fact that the records nevertheless show significant delta O-18 fluctuations highlights the need to base regional climate reconstructions on a regional suite of ice-core records. (Auth. mod.)

Grootes, P.M., and Stuiver, M., 1986, Oxygen Isotope Studies and Compilation of Isotopic Dates from Antarctica, *Antarctic Journal of the United States*, Vol. 21, No. 5, p. 122.

Abstract:

Oxygen-isotope studies conducted by the Quaternary Isotope Lab are listed and summarized. They include O-18 analyses of cores drilled at the South Pole, Dominion Range, and the Ross Ice Shelf, and of surface samples from the Siple Coast and McMurdo Ice Shelf. A compilation of radiometric dates from Antarctica containing abstracted information from 400 publications is now available. Radiocarbon as well as other dating methods are included. The nearly 2,500 separate entries give basic information on the sample site as well as the dating method and age of the sample analyzed. The O-18 measurement of the Ross Ice Shelf core at J-9 has been completed. The oldest inland ice is over 30,000 yr old. Comparison of the J-9, Byrd Station, and Dome C O-18 profiles shows O-18 change in antarctic cores to be influenced first by a general climatic change and second, local topographic changes.

Masson, V., Vimeux, F., Jouzel, J., Morgan, V., Delmotte, M., Ciais, P., Hammer, C., Johnsen, S., Lipenkov, V.Y., Mosley-Thompson, E., Petit, J., Steig, E.J., Stievenard, M., Vaikmae, R., 2000, Holocene Climate Variability in Antarctic Based on 11 Ice-Core Isotopic Records, *Quaternary Research*, Vol. 54, No. 3, p. 348-358.

Abstract:

A comparison is made of the Holocene records obtained from water isotope measurements along 11 ice cores from coastal and central sites in east Antarctica (Vostok, Dome B, Plateau Remote, Komsomolskaia, Dome C, Taylor Dome, Dominion Range, D47, KM105, and Law Dome) and west Antarctica (Byrd), with temporal resolution from 20 to 50 yr. The long-term trends possibly reflect local ice sheet elevation fluctuations superimposed on common climatic fluctuations. All the records confirm the widespread Antarctic early Holocene optimum between 11,500 and 9000 yr; in the Ross Sea sector, a secondary optimum is identified between 7000 and 5000 yr, whereas all eastern Antarctic sites show a late optimum between 6000 and 3000 yr. Superimposed on the long time trend, all the records exhibit 9 aperiodic millennial-scale oscillations. Climatic optima show a reduced pacing between warm events (typically 800 yr), whereas cooler periods are associated with less-frequent warm events (pacing 1200 yr).

Mayewski, P.A., 1995, Ice-Core Based, Late Holocene History for the Transantarctic Mountains, Antarctica, *Contributions to Antarctic research IV, American Geophysical Union, Antarctic Research Series*, Vol. 67, No. 4, p. 33-45.

Abstract:

Ice core records developed from two shallow sites in the Transantarctic Mountains provide documentation of much of the Holocene paleoenvironmental history of this region. From the more southerly site, Dominion Range, a 7000-year long record reveals change in the influence of tropospheric transport to the region. At this site, milder conditions and increased tropospheric inflow prior to 1500 yr BP are characterized by increased seasalt (ss), terrestrial and marine biogenic inputs. Increased persistence and/or extent of polar stratospheric clouds accompanying generally cooler conditions characterize much of the period since 1500 yr BP. From the more northerly site, Newall Glacier, the dramatic influence of the retreat of grounded ice from McMurdo Sound dated at <6600 yr BP dominates much of the ice core record. This regional environmental change is documented by massive influxes to the core site of evaporitic salts from areas exposed during low lake level stands. During the past 150 yr, both Dominion Range and Newall Glacier appear to be experiencing an overall increase in the exposure of ice-free terrain. (Auth.)

Mayewski, P.A., and Lyons, W.B., 1985, Using an Ice Core to Characterize the Climatic History of Antarctica, *Antarctic Journal of the United States*, Vol. 20, No. 5, p. 71-72.

Abstract:

Between 20 Nov. and 14 Dec. 1984, a remote tent camp was operated in the Dominion Range on an ice-covered massif located at the confluence of the heads of the Beardmore and Mill Glaciers in the Transantarctic Mountains. The main task at the site was to retrieve an ice core from which chemical and physical time-series will be made available to help in assessing: (1) current stability of the east antarctic ice sheet, (2) current models concerning the recent glacial history of the Transantarctic Mountains, (3) the presence of relatively high frequency climatic signals, and (4) the possible relationships between volcanic and/or solar activities and climatic change. Shallow snowpits were dug at several sites around the drill site, a 6-m snowpit was dug immediately adjacent to the drill site, and fresh and old surface snow samples were collected throughout the study area. The snowpits will provide samples that can be used to calibrate chemical analyses, to replicate studies, to assess seasonal signals in the chemical species and to collect other data sets including a temperature profile, density, and stratigraphy.

Ozone

Mayewski, P.A., Spencer, M.J., Lyons, W.B., Twickler, M.S., Dibb, J.E., 1988, Ice-Core Records and Ozone Depletion--Potential for a Proxy Ozone Record, *Antarctic Journal of the United States*, vol. 23, No. 5, p. 64-68.

Abstract:

In 1984, a detailed glaciochemical program was conducted that included collecting a 201-m core, collecting snowpit-samples, and taking surface-snow samples at a site 500 km from the South Pole, in the Dominion Range. It is proposed that measurements of nitrate and/or chloride in polar snow/ice samples may provide proxy records of ozone depletion because of the role these species play in the ozone cycle. Results of examination of the general trends in the time-series of nitrate ion and chlorine ion in the snowpit/ice cores are highlighted. The record discussed in this paper is considered suitable as a pilot study; it is pointed out that the South Pole provides an optimal site for a study that would firmly demonstrate and develop a proxy record of ozone depletion.