# Meetings

## Precambrian Sedimentation in the Canadian Shield

The father of geology, James Hutton, said that "there is a circulation in the matter of the globe. . . . This world is thus destroyed in one part, but is renewed in another." The fragmentary remains of this circulation, the preserved supracrustal rocks, hold many clues which, with proper interpretation, may help to solve the problems of the early history of the crust of the earth. With only one or two exceptions the oldest rocks of the Canadian Shield are supracrustal rocks—stratified volcanic, pyroclastic, and sedimentary rocks. These rocks contain almost the only surviving information about the "oldest" crust of Archean times. Study of the preserved sedimentary rocks might also give an insight into the tectonic state and thermal regime of the early crust. Chemical sediments can provide evidence about the composition of the ancient hydrosphere and atmosphere. Any attempt to reconstruct the geography of the Precambrian must include investigation of sedimentary structures.

Since the classic work of F. J. Pettijohn (*1*) in 1943 on Archean sedimentation, there have been a number of new developments in sedimentation. Perhaps the most notable advances include development of the turbidity current concept, rediscovery and development of carbonate petrography, and the popularization of paleocurrent analysis techniques. Development of these and other new techniques, together with greatly improved logistical support, has made possible the study and interpretation of many large and remote areas of the Canadian Shield. It was considered an appropriate time to bring together a number of sedimentologists working in the Precambrian of the Canadian Shield and its extensions into the United States.

A symposium was held at the University of Western Ontario in London on 14 and 15 April 1970. Twelve authors, including three from the United States, presented nine papers at the meeting.

Proterozoic rocks were the subject of the first session, which began with a discussion by P. F. Hoffman (Geological Survey of Canada) of some aspects of the carbonate rocks of the Great Slave Lake region. He showed that it is possible, even in the very old rocks comprising the carbonate assemblage of the Pethei Group, to carry out a detailed analysis of facies variation from bank interior to basin. He also pointed out the many advantages and some of the dangers of using present-day models to interpret Precambrian carbonate rocks. In particular, he accentuated differences to be expected in the older rocks owing to the absence of algae-eating metazoans. On the opposite margin of the Canadian Shield far to the southeast lies a relatively unknown area of Proterozoic sedimentary rocks—the Mistassini-Otish basin of northern Quebec. Cross-bedding studies in the clastic rocks of the Otish Mountains region by E. H. Chown (Loyola College) and J. L. Caty (University of Montreal) indicated transport to the southwest in some parts of the succession and to the northeast in others. The northeasterly currents may reflect reworking of earlier deposited sediment or may reflect a southerly source for some of the materials. Stratigraphic studies of the various Proterozoic outliers of this region permitted the tentative interpretation that the carbonate rocks of the Mistassini "Series" to the southwest are the marine equivalent of the dominantly clastic Otish Mountains Group. G. B. Morey (University of Minnesota and Minnesota Geological Survey) presented a summary of present knowledge of the Animikie or Middle Precambrian miogeosynclinal sedimentary rocks of northeastern Minnesota. Cross-bed data indicate southerly transportation of most of the materials in the northern part of the area, but flute and groove casts were found to indicate a direction of transport normal to this. He suggested the possibility that the Middle Precambrian rocks of the Cuyuna region were derived from the south, and he tentatively outlined a shoreline with an Archean massif to the south.

The second session was devoted to the Archean. R. W. Ojakangas (University of Minnesota and Minnesota Geological Survey) gave an account of volcanism and sedimentation in the classical Archean area of northeastern Minnesota. Some new structural and stratigraphic interpretations were made on the basis of top determinations in both volcanic and sedimentary rocks. Comparison was made with the volcano-sedimentary associations described by E. M. Goodwin from other parts of the Superior province, and emphasis was placed on the strong volcanic contribution to the sedimentary rocks. From a more northerly part of the Superior province, R. G. Walker (McMaster University) and F. J. Pettijohn (Johns Hopkins University) gave a detailed account of the structure, sedimentary history, and petrography of the Archean rocks at Minnitaki Lake in northwestern Ontario. They emphasized the importance of turbidity currents in deposition of the Archean sediments and, in contrast to the conclusions of Ojakangas for the more southerly area, presented petrographic evidence in favor of a "granitic" source for much of the sedimentary fill. A discussion of the Archean Burwash Formation of the Yellowknife area was presented by J. B. Henderson (Geological Survey of Canada). He described a thick succession of graywackes and shales, which he considered to have formed largely by turbidity current action. It was argued that the present outlines of the greenstone belt approximately define the margins of the original depositional basin. Paleocurrent analysis indicated a westerly source that consisted of both plutonic and silicic volcanic rocks.

F. W. Chandler (Ontario Department of Mines) and G. M. Young (University of Western Ontario) began the third session with a paper in which evidence was put forward in favor of a glacial origin for three Huronian paraconglomerates (Ramsay Lake, Bruce Formation, and Gowganda Formation, in ascending stratigraphic order). The relative textural and mineralogical maturity of the two older conglomerates was explained as being due to incorporation of earlier deposited, unconsolidated Huronian sands into the glaciers. The

cyclical nature of a great part of Huronian sedimentation may be explained in terms of repeated glacial advance and retreat.

H. J. Hofmann (University of Montreal) provided many excellent examples of the diversity of life in the Precambrian. He also described a number of remarkable pseudofossils, including structures from the upper Huronian formerly considered as possible metazoans (see cover of *Science*, 28 April 1967). These structures are now interpreted as sand-filled shrinkage cracks, with corrugations formed by longitudinal compression.

J. A. Donaldson (Carleton University) summarized paleocurrent data for the Proterozoic rocks of the Canadian Shield and pointed out that, with few exceptions, the general pattern is centrifugal from a point somewhere in Hudson Bay. It was pointed out that at least part of Hudson Bay (Belcher Islands) is underlain by early Proterozoic rocks and that a source for these sediments must be sought. Donaldson's presentation was a good example of what P. E. Potter and F. J. Pattijohn have called "beyond basin analysis"—paleocurrent analysis on the continentwide scale.

Presentation together of results from Archean and Proterozoic areas reemphasized the differences between rocks of different ages and, indeed, between Archean rocks of different areas. More detailed petrographic and paleocurrent studies of Archean sedimentary rocks are urgently needed if the nature of greenstone belts and their relationships to the original sedimentary basins are to be understood. The Proterozoic sedimentary rocks, because of their greater diversity and their similarity to Phanerozoic rocks, provide ample opportunity for comparison with the younger sequences. Precambrian stratigraphers and sedimentologists should be cognizant of current developments in the study of the Phanerozoic "overburden." Several persons emphasized the need for interdisciplinary study of the Precambrian.


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**Reference**


1. F. J. Pettijohn, *Bull. Geol. Soc. Amer.* **54**, 925 (1943).


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