age indicators, such as drainage density changes, hypsometric integrals, bifurcation ratios, stream junction angles, spur morphology and hillslope geometry. The employment of paleosols as a relative age dating tool was examined by W.J. Vreeken (Queen's Univ.). He reviewed several principles of age relationships between soils and surfaces, and summarized the use of soil properties as time indicators. The use of pollen assemblages to check the accuracy of radiocarbon dates and for relative dating beyond the range of 50,000 yrs. formed the nucleus of the discussion by A.M. Davis (Univ. of Toronto). He explored numerous problems resulting from variations in pollen spectra, redeposition of pollen from older sediments, size of the pollen sum, and use of numerical clustering methods. Changes in vertebrate faunal groups from Blancan, through Irvingtonian and Rancholabrean Land Mammal ages was discussed by C.R. Harington (National Museums of Canada, Ottawa). He analyzed the evidence for the first appearance of *Bison* in North America at the end of the Irvingtonian Age as well as conflicting absolute age determinations on the same materials. The use of Pleistocene insect assemblages to differentiate particular interglacial and interstadial geological horizons in Britain and North America was described by A.V. and A. Morgan (Univ. of Waterloo). They reported on the degrees of similarity among insect faunas in different beds of Sangamonian age and discussed the major difficulties involved in correlation.

The final session began with a report by A. MacS. Stalker on till sheet characteristics from several sections in the southwest Canadian Prairies. Deposits are distinguished by postglacial chemical alteration, compaction, structure, jointing, style of breakage and oxidation features. C.W. Finkl (Nova U., Dania, Fla.) investigated the chronological ordering of pedological episodes vital to the reconstruction of paleoenvironments. He stressed the importance of micromorphological data as a tool in establishing chronological sequences of soils, especially in deeply weathered tropical terrain. W.C. Mahaney, D. Halvorson, J. Piegat and K. Sanmugadas (York Univ.) evaluated multiple dating methods used to differentiate Quaternary deposits in the Wind River and Teton ranges, Wyoming. They stressed the importance of lichenometry, weathering characteristics and soils as age indicators, and paid particular attention to the use of Fe ratios (oxalate extractable/dithionite extractable iron) and quartz/feldspar ratios, clay mineral composition, and organic properties in age differentiation. Relative and absolute dating methods applied to dating late glacial sediments in the Lake Agassiz Basin provided the basis for discussion by R.W. Klassen (Geological Survey of Canada, Calgary). He assessed the discrepancy between absolute and relative chronologies, and suggested that the oldest ^{14}C dates may be contaminated with dead carbon. The relative chronology suggests a shorter time interval because it does not account for several low water stages of Lake Agassiz and at least one major readvance of continental ice. W.J. Wayne (Univ. of Nebraska, Lincoln) described the use of several relative dating methods used in the Rio Blanco Basin, Cordon del Plata, Mendoza Province, Argentina, to date glacial and periglacial deposits. These methods included zircon fission track, deposit morphology, loess thicknesses, soil profile development, vegetation characteristics and lichens.

The papers were followed by a panel discussion on Saturday evening. The panel was chaired by C.S. Churcher (Royal Ontario Museum, Toronto), D.R. Coates, H.B.S. Cooke and J. Terasmae. They reviewed and assessed the information presented by various speakers. This ended with a short, but lively discussion led by C. Kolb (Louisiana State Univ., Baton Rouge, La.) on the suitability of salt domes in Louisiana for nuclear waste disposal. The importance of using various dating methods to determine the ages of salt domes and overlying stream terraces cut in late-Tertiary sediments formed the major thrust of his discussion.

The Symposium abstracts-with-program and field guide may be obtained from W.C. Mahaney for $3.00. The proceedings will be published in 1982 by A.M. Dowden Inc., Stroudsburg, Penn.

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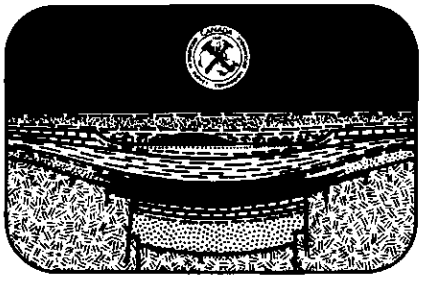

Geological Survey of Canada's Current Activities Forum

R.W. Macqueen
Department of Earth Sciences
University of Waterloo
Waterloo, Ontario N2L 3G1

About 300 people braved the rigours of one of the coldest Januarys on record to listen to 20 talks and view 34 technical exhibits over January 20 and 21, 1982, at the Skyline Hotel, Ottawa. Some 200 of them are used to such weather - they live in Ottawa. The remainder came from points as distant as Halifax and Vancouver. For some time the GSC has been asked by industry spokesmen to hold an annual review somewhat along the lines of the successful Yukon and NWT forums held each December. The Ottawa meeting is a response in part to these requests. A first, it was successful and may well become an annual affair.

Brand-new GSC Director-General R.A. Price, 20 days into this new career but with all the right credentials and skills, welcomed attendees to the Forum, noting that the GSC's responsibilities include increasing our understanding of the country both for the development of resources and for the wise use of the land. Deputy Director-General J.G. Fyles told participants that the GSC has a total manpower of about 750, including 250 scientists, and has about 450 active projects, 200 of which involve field work.

The 19 technical papers that followed were organized in a somewhat random fashion, perhaps to encourage everyone to take in the complete program. Papers group into about six areas: Precambrian geology, mineralization, geophysics, exploration methods using surficial materials, surficial material studies, and mineral resource appraisal. At least 11 of the 19 talks had one page typewritten abstracts available.

What better way to start off a Precambrian session than with Paul Hoffman's elegant account of the tectonic zonation and origin of the Wopmay Orogen, surely

proof of the operation of Phanerozoic-like plate tectonics in early Proterozoic time. Comprehensive 1:50,000 scale mapping, combined with uranium-lead zircon dating and other techniques (including 9 current Ph.D. thesis projects in the area), have made this area and work a jewel of the Canadian Precambrian. Hoffman's maps and synthesis also were on display in the poster sessions. Other Precambrian contributions included a paper by Mikkel Schau on the Baker Lake area, details from Bob Baragar on the ultramafic komatiite flows of the circum-Superior Belt of eastern Hudson Bay, and an account by A. Davidson of the tectono-metamorphic framework of the Parry Sound region of the Grenville Province, described in some detail in GSC Paper 82-1A. As an occasional holiday visitor to the Parry Sound region, I've been awed by the complexity of these rocks. Davidson showed, however, that on careful study, patterns do emerge, and that rational and instructive interpretations are possible in this most difficult yet accessible of geological terranes.

Five papers were directly concerned with metallic mineralization. Murray Duke outlined a model for the origin of disseminated magmatic sulphide deposits found in the shallow volcanic sill intrusive portions of komatiite magma suites. Although the grade of these deposits is low (0.6 to 0.7% Ni), it is consistent, and reserves are large. The remaining four papers dealt with sediment-hosted mineralization. Fred Chandler has been studying the geological environments of iron-manganese, copper, and lead-zinc mineralization in early Proterozoic rocks of the east coast of Hudson Bay. Stratigraphy and rock types are the major controls on these occurrences, and analogies were made with younger producing Phanerozoic deposits. Three papers presented new work stemming from the GSC's Nahanni Study, a regional project centred on the economically "hot" Selwyn Basin with its numerous shale-hosted lead-zinc and barite deposits. From his work at Howard's Pass, Wayne Goodfellow recognizes vertical and lateral gradients in a number of metallic elements, in the rocks that enclose the stratiform lead-zinc mineralization and in overlying rocks. These gradients and other stratigraphic and lithologic characteristics provide exploration guides, and support the conclusion that Howard's Pass represents a fault-bounded third-order basin. Ian Jonasson's talk focussed on surface weathering characteristics at Howard's Pass. The large surface water and stream sediment zinc anomalies by which the Howard's Pass deposit was found, result from erosion of the secondary weathering products zincite and hemimorphite, both abundant in marly peat and local cemented talus. Distinctive bright green mosses are also particularly abundant associated with these showings, and the mosses are zinc accumulators. John Lydon discussed his and Jonasson's work on the geochemistry of stratiform barite deposits of Middle Devonian and younger age in the Selwyn Basin. They are looking at differences between barite associated with lead-zinc deposits, and that remote from such deposits, as an indication of genesis and possibly a guide to exploration. With some 27% of the free world's barite currently derived from similar deposits in Nevada, there is plenty of economic incentive to study these important Canadian occurrences.

Geophysically-oriented papers were three in number. D.J. Teskey discussed the production of the GSC's 1:1 million magnetic anomaly map series, designed to help fill the gap between magnetic anomaly maps at 1:250 thousand and 1:5 million scales. Data to produce these maps are digitized: the new magnetic anomaly map of the Canadian Arctic, available at the meeting, provides an example. L.J. Kornik's presentation outlined the production of aeromagnetic vertical gradiometer maps of magnetic signature - these provide close correlation with the magnetic character of rocks at or near the surface, because the total field effect is lessened. Examples from Val d'Or Quebec and the Halifax area showed the excellent correlation between known surface geology and vertical gradiometer maps. It is clear that this is an important technique of bedrock mapping in areas of poor exposure. A.V. Dyck's talk dealt with an area of much interest, the derivation and interpretation of drill-hole electromagnetic surveys in mineral exploration. These techniques are cardinal in exploration of the so-called "new frontier" in mineral exploration - the uppermost 100 to 200 m of the earth's crust.

Exploration methods using surficial materials were discussed in a number of papers. Here, J.D. Adshead outlined controls on the distribution of uranium in Arctic lake bottom sediments near the west shore of Hudson Bay. Depending on stratigraphic level and age, these sediments accumulated either below or above former marine limits during Pleistocene glaciation. Distributions of uranium in the clay fraction are strongly controlled by the original depositional environment - marine sediments have only 3 to 4 ppm uranium, whereas freshwater sediments may reach as much as 20 ppm where high regional background is found. R.N.W. DeLabio compared Canadian and Fennoscandian approaches to prospecting using glacial drift. The Fennoscandians operate in terrane similar to Canada although much smaller in area. They see glacial dispersal as the most important aspect of drift prospecting, and accordingly have conducted detailed studies of till stratigraphy and mineralogy for many years, rather than simply analyzing samples. Emphasis is on understanding the glacial environment as fully as possible, in order to interpret the geochemical results. Procedures normally regarded as unduly laborious in Canada, for example boulder tracing and analysis of large numbers of samples, are routine in Finland. DeLabio suggested that Quaternary geology should be a required course in all Canadian university geology programs.

Glacial drift can be studied in its own right. J.A. Hunter outlined the "optimum window reflection technique" used in shallow seismic study of drift. Here only those reflections are used that most clearly delineate the depth to bedrock surface or the internal stratigraphy of drift materials. Many geochemical, geotechnical, paleoecologic or permafrost studies require samples of drift materials, however, and Jean Veillette reviewed the various portable drilling tools and sampling devices used by GSC in many parts of Canada, including the high Arctic. The GSC group have specialized in the development of sampling devices appropriate to particular projects, locations, and costs.

Finally (although they were not last on the program), three papers were given on mineral resource appraisal. Geoff Leech introduced these papers by noting that the GSC is involved in this work as a public service function at the request of other government departments, but not in a policy role. Inventories of mineral and fuel resource potential are required before land is set aside for park purposes. Leech emphasized that estimates are subjective and qualitative, given all the uncertainties involved. They depend fundamentally on our understanding of mineral deposit types and the geological environment in which they occur, as well as the terrane being evaluated. W.D. Sinclair and G.B. Leech outlined methods used in a Yukon study, involving comparison of a deposit model with a particular terrane. Yukon was divided into 60 separate tectonic-lithostratigraphic domains, and each was assigned a rating as regards occurrence of a particular deposit type. As subjective as they are, in my view these estimates also provide guides on where we need to improve knowledge of deposit types and regional

geology - ideally, the estimates can provide a focus for future work and a catalyst to conduct such studies as the Nahanni project noted above. S.M. Roscoe's contribution was a qualitative assessment of the potential mineral resources of the Bathurst Inlet area, Canadian Shield. Many precious and base metal showings are known, in a complex variety of geological settings. The area has the advantage of being close to possible future shipping sites. The most promising targets are copper and uranium in Proterozoic rocks.

G.F. Bonham-Carter outlined the approach that he, C.F. Chung and A.G. Fabbri are taking in treating mineral occurrence data by computer-based techniques. An area in northern Manitoba provides various geological, gravity, aeromagnetic and airborne radiometric data. Digitizing these data permits graphic plotting of a large number of combinations of data. For example, it is possible to prepare maps comparing lake sediment uranium values with uranium/thorium patterns in bedrock, leading to reasonable prediction of known occurrences and new prospective areas. Again, this work depends fundamentally on the quality and amount of basic data available, as well as the nature and validity of the assumptions underlying the various computations.

Who attended the forum? A list of first-day registrants names and affiliations made available on day 2 had about 280 names on it - 120 GSC people, 80 mining company and related industry people, 40 university types, 15-20 consultants, 15 provincial government employees and various other federal government personnel. And the format? Talks were 25 minutes, and although there was little discussion from the floor, there was much informal discussion in the halls and in the adjoining poster session room over the two days. Three of the poster sessions were directly related to talks, 5 were partly related, and the remaining 26 dealt with other topics, mostly generally related to aspects of mineral exploration. A list was provided of the poster sessions, which were mostly well-done and informative (and "a helluva lot of work", according to one poster session preparer). Many poster preparers were available at an informal evening session held on day one. About 30 to 40 separates were available from GSC Current Research, Paper 82-1A. A publication booth featured the new Proterozoic Basins in Canada volume just off the press as GSC Paper 81-10, the new Cordilleran Tectonic Assemblage map 1505A, the new magnetic anomaly map of Arctic Canada (map 1512A), and several new magnetic anomaly maps of the Val d'Or area.

Several minor criticisms seem in order. The meeting was not well enough advertised - I learned of it only because I subscribe to the GSC publications mailing list directly, and this was the main form of advertisement. Others, even local Carleton and Ottawa University people, only learned of it once the meeting had begun. This is unfortunate, because the presentations were of interest to anyone with regional or mineral exploration interest in Canada. Better advertising might have lured more academic types, although January is a busy month in academe. Talks, as at GAC/MAC and other meetings, were outstanding to rarely mediocre, as were slides. Photographs of published maps and tables of data are just not acceptable. Some speakers would do well to follow the general rule of thumb: one slide, one concept; one slide, one minute. The outstanding work by scientists in GSC's other offices, Vancouver, Calgary and Dartmouth, was not presented here. Perhaps in future a single speaker might report for each of these settings, giving a 25 minute field season highlight account - or, a few speakers from these far-flung outposts could be conscripted for the Ottawa meeting. It is not clear to me whether the meeting was aimed primarily at the mineral exploration community as it seemed to be, or at the greater earth science community with a strong interest in regional geology. Inclusion of presentations from across the county at future meetings obviously will depend on just what community is viewed as of most interest. Perhaps some guidance and direction will surface from the questionnaire which all attendees were asked to complete. Many did so.

But these are relatively minor points which can be addressed if this forum becomes an annual or bi-annual event as I, for one, feel it should. There is some outstanding work being done by GSC scientists, and the forum provided both a showcase for it and an opportunity for much first-hand contact with all speakers/poster session preparers/attendees. A well-done first effort.

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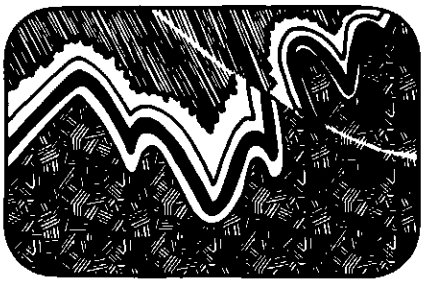

Rock Deformation Meeting: Canadian Tectonics Group

P. Stringer
Geology Department
University of New Brunswick
Fredericton, New Brunswick E3B 5A3

The first meeting of the Canadian Tectonics Group, convened by Dr. Paul F. Williams, was held in the Geology Department, University of New Brunswick, Fredericton, October 16-18, 1981. Twenty-two participants, invited from across Canada registered. Papers and poster sessions were presented within the general theme of rock deformation which was divided into two parts: structure and tectonics, and detailed and general structural mechanisms. A post-session field trip along coastal southern New Brunswick was arranged by the writer to examine and discuss structures in Ordovician to Triassic sedimentary rocks resulting from Ordovician (Taconic), Devonian (Acadian), Carboniferous (Variscan) and Late Triassic (Palisades) deformation.

The Precambrian session, the first of three on structure and tectonics, opened with a well-illustrated paper by Bill Fyson on enigmatic time relationships between conformable and cross-cutting structures in supracrustal sediments and volcanics bordered by granitoid rocks in the Slave Province, near Yellowknife. Nick Culshaw interpreted the SE plunging L-S fabrics in Grenville Province gneisses near Bancroft, Ontario, as a result of NW directed, ductile thrusting that subsequently switched to locally concentrated shear deformation, opposite to but diagnostic of, the regional shear sense. Claude Hubert gave a paper on mega-shear tectonics in the Abitibi Volcanic Belt, Rouyn - Val D'Or, Quebec. In a further contribution to his well-documented research on strain patterns in diapiric gneiss domes of the Superior and Grenville Provinces, Fried Schwerdtner argued that a significant component of the total strain predated the doming in the granitoid cores