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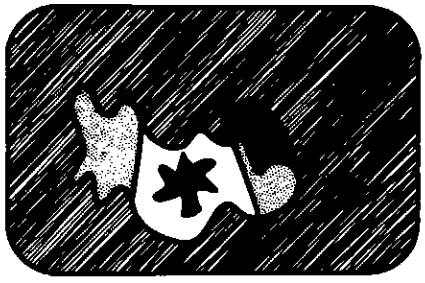

Canadian Tectonics Group

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The sixth annual meeting of the Canadian Tectonics Group was held in Sudbury, Ontario, on 18-19 October 1986. This year's meeting was extremely well-attended, attracting a total of 70 participants, consisting of university faculty, students and members of government surveys from Canada and the United States. The meeting followed the usual format of one full day of oral presentations and poster displays and a full-day field trip. This year's field trip involved a walk across the Grenville Front Tectonic Zone at Coniston, Ontario. Interesting features seen on the trip included mylonites and ultramylonites of varying composition, several different types of kinematic indicators and various types of folds. The origin of the various folds soon became the most popular topic of debate. Organization of this year's meeting was handled by Don Rousell (Laurentian U) and Paul Clifford (McMaster U).

Oral Presentations

The conference began on Saturday with a well-organized session of 19 oral presentations which consisted of a wide variety of topics related to structural geology and tectonics. The chairmen for the session included Bill Fyson (U of Ottawa), Chris Mawer (U of New Mexico), John Starkey (U of Western Ontario (UWO)) and Phil Simony (U of Calgary).

Graham Borradaile (Lakehead U) discussed the relationship between the change in magnetic susceptibility anisotropy and the finite strain in a rock. This train of thought was continued in the next talk, presented by Craig Alford (grad. student, Lakehead U), on simple shear rock mechanics experiments and magnetic fabrics. From these studies, it appears that the change in the anisotropy of the magnetic susceptibility during deformation does bear a consistent relationship to the finite strain ellipsoid in cases of both pure and simple shear.

A discussion on the criteria used to distinguish between preferred orientation foliations resulting from primary sedimentary processes, soft sediment deformation and tectonic deformation was presented by Colleen Elliott (grad. student, U New Brunswick (UNB)). John Starkey introduced a technique for relating quartz grain shape to c-axis orientation which is to be used in a study of rocks of known deformational history. It is hoped that this study will allow the relationships between these features to be used in the future to infer deformational history. Joe White (UNB) presented evidence of recovery, including dynamic recrystallization and exsolution, in perthites from Parry Sound, Ontario, indicative of deformation at crustal depths on the order of 40 km. Simon Hanmer (Geological Survey of Canada (GSC)), continuing where he left off at last year's meeting, discussed the nature of the deformation in the Great Slave Lake Shear Zone. This shear zone, which separates the Slave and Churchill-Provinces of the Canadian Shield, was apparently initiated within a belt of granites, the equivalents of which are not represented outside of the shear zone. A decrease in metamorphic grade with time has been accompanied by a narrowing of the zone of active shearing to produce an ultimate chlorite-grade ultramylonite.

Fried Schwerdtner (U of Toronto) introduced Arcuate Intrafold Decollement Zones (AIDZ) as being responsible for the disharmony observed within many folds. A portion of the Eureka Sound fold-and-thrust belt and the Parry Sound Domain of the Grenville Province were cited as possible examples of these structures. Folds in Devonian carbonates of the Rocky Mountain Front Ranges were discussed by Phil Simony. Recent mapping within the McConnell Thrust sheet has shown that a large amount of crustal thickening has been accomplished through folding where it had previously been mapped as resulting from minor thrust faulting. Willem Langenberg (Alberta Research Council) discussed several features of structurally thickened coal of the Smoky River Coal Field near Grande Cache, Alberta. These features include duplex structures, which have become a major exploration target in the area. Continuing on a regional scale, Howard Williams (Brock U) presented evidence from the Himalayas in India which suggests that regional scale thrusting may be initiated at depth by high temperature melting. Subsequent intrusion of granitic melt is channelled along the thrust, acting as a lubricant. Thrust-parallel, elongate, granitic bodies with highly deformed margins but essentially undeformed cores result from this process.

Don Rousell illustrated the nature of the Grenville Front in the Baby Lake area, Ontario, which acted as an introduction to the field trip the following day. In this area, the Wanapitei Fault separates mildly deformed rocks of the Southern Province to the northwest and a 400m-wide mylonite zone to the southeast. This zone contains a sequence of quartz mylonites (derived from the Mississagi Formation), granodiorite mylonite, and tremolite metagabbro layers. At the southeastern boundary of this zone is the so-called Grenville Front Boundary Fault (GFBF) which is actually a transitional boundary separating one style of deformation from another. Southeast of the GFBF is a mylonite-migmatite zone consisting of two SE-dipping layers of quartz-feldspar mylonite separated by migmatite and overlain to the SE by migmatite, mylonite, kyanite schist and breccia.

Hyari Koral (grad. student, UWO) presented many of the features he has observed during his study of ductile deformation within the Whitestone Anorthosite in Parry Sound, Ontario. Jack Henderson (GSC) discussed how asymmetrical folds can be used reliably as shear criteria in mylonite zones. Remaining on the topic of shear zones, Chris Mawer discussed a possible role of fluids in shear zones and the timing of fluid introduction. This topic seemed to raise more questions than answers: What are the fluid sources? Is there periodic introduction? How and where does the fluid collect? How does it move? What is the rate of generation and movement?

Subhas Tella (GSC) discussed his structural studies in the Rankin Inlet, NWT. Based on evidence from structural facings and bedding-cleavage relationships, he has determined that two tectonic breaks exist. Selim Hannan (grad. student, U of Toronto) presented some of the results of an experimental study he has undertaken to characterize the deformation of contacting fracture surfaces under normal stress. Paul Budkewitsch (grad. student, U of Toronto) presented evidence for a western allochthon in the northern Labrador Trough.

Problems in structural analysis in the Bathurst Camp, northern New Brunswick, were presented by Cees van Staal (GSC). During his somewhat controversial discussion, he re-emphasized the importance of good mapping practices in structurally complex terranes so that important structural data are not overlooked. The session ended with an enjoyable talk from Timothy Kusky (Johns Hopkins U) on new evidence, including ultramafic rocks and mélange units, which suggest an ophiolitic origin for Slave Province greenstone belts. The recognition of ultramafic rocks and sheeted dyke complexes, originally mapped as sediments, indicates that the Slave Province does not differ from other Archean granite-greenstone terranes, as was previously suggested.

Posters

The walls of the conference room were used on Saturday to support a number of poster presentations. W.G.W. Maitland (grad. student, UNB) and J.C. White presented some observations leading toward the characterization of sub-solidous phenomena in deep crustal pyroxenes. Frank Fueten (grad. student, U of Toronto) showed photomicrographs illustrating gneissic deformation in the Thompson Belt, Central Manitoba.

Howard Williams (Brock U) presented a stick-slip model for kink band formation in shear zones and faults.

K.M. Bethune (grad. student, Queen's U) displayed an analysis of stress orientation in a gentle fold of the Valley-and-Ridge Province, Central Appalachians. S.G. Hwang (grad. student, UNB) displayed complex implications of shear zones in the Shelburne-Berrington area, Nova Scotia. C. Hy (UNB) showed quartz vein history in the Tangier area from the eastern shore of Nova Scotia. C. Moreton (grad. student, UNB) showed major structure controls on the B-zone ore body, Heath Steele Mines, Newcastle, New Brunswick.

Echelon fracture sets in felsic rocks of the Killarney Complex were displayed by Paula MacKinnon (grad. student, McMaster) and Paul Clifford. Pierre-Yves F. Robin (U of Toronto) showed a new method of dealing with the representation and evaluation of circular orientation data. The theoretical basis and method of dating geological events from ESR (electron spin resonance) signals in quartz was displayed by W.M. Buhay (grad. student, McMaster), H.P. Schwarcz (McMaster) and P.M. Clifford.

On a more regional scale, J.E. King (GSC) showed contrasting styles of basement involvement in the metamorphic-internal zone of the Wopmay Orogen. C.K. Mawer displayed a poster illustrating some aspects of the tectonic history of the northern Appalachians. B.H. O'Brian (Dept. of Mines and Energy, Newfoundland) showed auriferous mylonite zones in southwestern Newfoundland. R.M. Stesky (U of Toronto) showed lineaments and faults of the Ontario Grenville Province.

Graham Borradaile has offered to host the next Canadian Tectonics Group Meeting in Thunder Bay. If you wish to receive the first circular, contact: Dr. Graham Borradaile, Dept. of Geology, Lakehead University, Thunder Bay, Ontario, Canada P7B 5E1.

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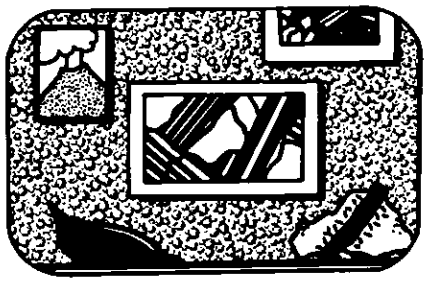

Friends of the Igneous Rocks: First Meeting

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On 6 September 1986, the first meeting of "Friends of the Igneous Rocks" was held at the University of Calgary. The meeting was attended by J. Nicholls, L. Lee, M. Stout (U of Calgary); T. Pearce, P.L. Roeder, A. Kolisnik, P. Scowen (Queen's); K. Russell (U of British Columbia); C. Scarfe (U of Alberta). The informal association was organized by a steering committee of K. Russell, J. Nicholls, P. Roeder and T. Pearce. The first meeting was ably hosted by Jim Nicholls and was held in a relaxed and open manner. Individuals were invited to give an informal presentation on their present research interests. There was considerable discussion of the work presented and, judging from the variety and topical nature of the work which was presented, igneous petrological research in Canada is in a very healthy and active state. Highlights of the presentations are described below.

J. Nicholls began the day's session with a discussion of problems involved in some statistical attempts at reproducing natural data by so-called randomly selected data. Attempts have been made by some statisticians (e.g. Rollinson and Roberts, Contributions to Mineralogy and Petrology, 1986) to "prove" that trends in ratio diagrams (i.e. Pearce diagrams) could be solely due to random data. It was shown that if the random data are constrained to have the same means and variances as a natural data set, then the random data will be constrained to reproduce the natural trends. The conclusion remains that trends in Pearce diagrams which test for magmatic fractionation are valid.

The present writer added to the discussion with comments based on a manuscript now in review. He introduced the concept of "available space" defined as the n-dimensional space outlined by permissible stable phases for any given state of a system. Any other space is "forbidden space" by definition and it is therefore impossible for data to fall within it. All natural data must fall within the available space and random data must completely fill the available space in a random manner. Needless to say, the present writer agrees that the trends in Pearce diagrams are valid. A correct null hypothesis is that data must randomly fill the available space.

P.L. Roeder reported on some work on chromium solubility in basalts which is being conducted in collaboration with Ivan Reynolds of Rhodes University. Using the famous 401 basalt, they found that, as is the case with ferric iron, chromium 3^+ is not very soluble in basaltic melts. Reporting new results (some obtained only the previous week), Roeder has modelled the solubility of chromium in basaltic melts at 1200 and 1300°C for a range of oxygen fugacities. Chromite may, therefore, be useful for determining P_{O_2} and total pressure in basalts. An interesting observation that came out of this work is that some mid-ocean ridge basalts have plagioclase which appears to have nucleated on chromite. Professor Roeder speculated that this might have something to do with the interchange of aluminum between the chromite and the adjacent melt as a function of pressure.

The intermediate mixed lavas of Volcan Popocatepetl in Mexico are being studied by Angela Kolisnik of Queen's University. She is using the Laser Interference Microscope at Queen's to study zoning in pyroxene and plagioclase phenocrysts. Reversely zoned orthopyroxenes with a more magnesian rim of enstatite deposited upon an inner resorbed core of hypersthene (with a difference of 14% En) is consistent with magma mixing. Some orthopyroxene even has oscillatory zoning reminiscent of plagioclase. This may be the first recorded appearance of such zoning. Plagioclase with several inner "spikes" of more calcic composition is also consistent with a mixing hypothesis and various models of mixing processes are being evaluated. The zoning stratigraphy in some microphenocrysts of plagioclase can be locally correlated from one phenocryst to another. However, for the most part, the assemblage of plagioclase phenocrysts appears rather heterogeneous. In thin section and in some hand specimens, two different phases can actually be seen as dark and light parts of the rock with different degrees of crystallinity.

After lunch at the local student eatery, the writer reported on several current projects. Using a newly developed, simplified theory of zoning (from a manuscript currently in review), it is theoretically possible to determine the distribution coefficient and the extent of the system from which a crystal has grown. This work, it is thought, has implications for determining the size of cells during magmatic mixing events. Some crystals of plagioclase, for example, have zoning patterns consistent with growth in a very large (even open?) system. Another project involving A.H. Clark, P.L. Roeder and I. Wolfson concerns the application of Nomarski interference contrast in reflected light to the