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V.M. Goldschmidt Conference

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Central Canada Geological Conference

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The inaugural meeting of the CCGC was held at the University of Western Ontario, 22-23 February 1988. These conferences are designed to provide an opportunity for graduate students to present their research as oral papers or posters, and thus meet others who have similar research interests. About 80 people registered, including 65 students, and 33 communications were presented, of which 25 were oral papers. In addition, talks by six invited speakers were interspersed with the other papers in the two-day program. A book of abstracts was available at the meeting. Twenty minutes were scheduled for most papers, and there was a fair amount of discussion following the papers, as well as the usual informal exchanges over refreshments. The conference was scheduled for "slack week" and all major graduate schools in Ontario were well represented (with the notable exception of McMaster!), as well as several in Quebec and nearby States.

The conference was well planned by a committee of nine graduate students, chaired by Brett Norris. The registration fee was $25, which included free coffee, doughnuts, and a cold buffet-style dinner on Monday night — so clearly it was well subsidized by its sponsors, which included the University of Western Ontario and the Canadian Society of Petroleum Geologists. CSPG also offered an award for the best student presentation, which was won by Clinton Cowan (Queen's University) for a paper on "Evidence for hydrothermal spelean Mississippi Valley Type mineralization: banded fluorite rhythmites of Southern Illinois".

The range of topics covered by the conference was quite diverse, ranging from environmental and groundwater studies, through petrology, metallogeny, palynology, allostratigraphy, and sedimentology, to structural geology and large-scale tectonics. It even included a paper on how graduate students could improve as TAs and themselves profit from the experience. The level of oral presentation was generally very high: colour graphics, of a type once thought to be restricted to rich oil company employees, were used lavishly. Almost no slides were illegible and all speakers were audible (with the possible exception of one of the invited speakers!). Luckily, the program was not crowded, otherwise a more rigourous enforcement of the time limits would have been necessary (the program ran as much as an hour behind schedule).

In reporting such a diverse conference, it would probably be invidious to single out any particular contributions for special discussion (those who hunger for details can obtain the Abstract Volume by sending $10 to the Department of Geology at UWO). Your correspondant will therefore report only that he found many of the student presentations very interesting, and even learned new things from the invited speakers, some of whom he has heard many times before. Most students while caught up in the enthusiasm of their first major research project are necessarily much concerned with the details of their studies. In view of the polydisciplinary nature of the conference, students should be encouraged to spend a little more of their time explaining the larger setting and implications of their work to their colleagues who may be specializing in other fields. But the main thing that is needed to make the conference even more of a success than it was is a larger participation: from graduate students themselves (perhaps particularly including those who are not giving papers), and from senior undergraduate students (who should certainly not be excluded from future conferences). Professional geologists should also attend in larger numbers, and participate in the discussion, both formal and informal. The graduate students themselves expressed the hope that next year's conference, which will be held in Toronto at about the same time, and organized by Mr. Laurent de Verteuil (University of Toronto), will attract a larger group of professional geologists from industry and government. Perhaps some organizations may even come to see the conference as a good place to seek out promising new employees.

At any rate, central Canada has fewer regional geological organizations than any other part of Canada (or the adjacent United States). The Central Canada Geological Conference is off to a good start, and deserves our wholehearted (and open-pocketted) support in the future.

V.M. Goldschmidt Conference

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Victor Moritz Goldschmidt is generally regarded as the father of geochemistry. He was born January 27, 1888 in Zurich, Switzerland, and studied mineralogy, geology, and inorganic and physical chemistry at the University of Oslo. He received his doctoral degree from the University of Munich in 1911, and three years later he was appointed Professor and Director of the Mineralogical Institute at the University of Oslo. In the 1920s, Goldschmidt almost single-handedly laid the foundations of geochemistry through his studies of the distribution of the elements in minerals and rocks using optical emission and x-ray spectroscopy. He made significant contributions to the field of crystal chemistry by analyzing crystal structures with x-rays, and by determing the ionic radii of the elements. His studies laid the groundwork for concepts on the genesis of many types of ore deposits, as well as models of the geochemistry of the earth on a planetary scale through the study of the chemistry of meteorites. He also studied the geochemistry of the individual elements, summarized in his now classic *Journal of the Geological Society of London* (1937) paper on "The Principles of Distribution of Chemical Elements in Minerals and Rocks". V.M. Goldschmidt died in Norway in 1947 at the age of fifty-nine, yet still managed to guide the fledging science posthumously through publication of his magnum opus, *Geochemistry*, in 1954.

Because of his extensive contributions to the field of geochemistry, it was only fitting that a major geochemical conference to mark the centennial year of V.M. Goldschmidt's birth was held in Baltimore, Maryland, 11-13 May 1988, immediately prior to the Spring Meeting of the American Geophysical Union. The V.M. Goldschmidt Conference was organized by the Geochemical Society, and was sponsored by the American Chemical Society, the Association of Exploration Geochemists, the European Association of

Geochemists, the Geochemical Society, the International Association of Geochemistry and Cosmochemistry, the Mineralogical Society of America, and the Society of Environmental Geochemistry and Health. In association with the meeting, Frank Hawthorne (U of Manitoba) organized a Mineralogical Society of America short course on "Spectroscopic Methods in Mineralogy and Geology", held on 13-15 May. Several one-day field trips were held in the Baltimore region in conjunction with the meeting on May 14 and 15.

The scope of the conference, which attracted roughly 500 geo- and cosmochemically inclined scientists, was as broad as Goldschmidt's, and included major sessions on "Modern Concepts in Crystal Chemistry", "Lithosphere-Asthenosphere Interactions", "Ore-Forming Processes: Source Regions and Transport of Metals", "The Geochemistry of Sulphur", "Trondhjemites", "International Geochemical Mapping", "Platinum Group Elements", "Cosmogenic Radionucleides", Environmental Geochemistry", "Organic Geochemistry", the "11th Symposium on Geochemical Cycles", and a number of general sessions.

About 300 oral and poster presentations were given at the conference, and roughly a third of the attendees were non-U.S. citizens; with Canada being well represented by scientists from several universities and provincial and federal government organizations. Sessions were run concurrently, with up to seven simultaneous sessions. This was necessary given the breadth of subject areas encompassed by modern geochemistry, but unfortunately prevented much of that commonly useful cross-fertilization which occurs when one is forced to pay attention to subjects on the apparent fringe of one's expertise. Consequently, it is not possible for a single person to cover all of the presentations at the meeting; however, I will report on some of the sessions that I attended that may be of interest to *Geoscience Canada* readers.

The session on "Lithosphere-Asthenosphere Interactions" was dulled by the absence of two of the nine scheduled contributors. Most of the presentations dealt with the latest in isotopic studies related to the subject and their application in mapping mantle heterogeneities. In particular, Re and Os are the latest thing in the isotope world, and Luck, Pegram, and Allegre (France) have improved Re and Os extraction and purification techniques to the point of allowing the study of ultramafic and mafic rocks, although it will still be some time before agreement can be reached on the significance of the data obtained so far. Walker, Shirey, Balakrishan and Horan (United States, India) reported on the use of Os isotopes to help understand the timing and sources of platinum-group element (PGE) enrichments, and in future this may aid in the search for PGE mineralization. Of all the talks in this session, the presentation by Kay and Kay (Cornell U) was the most thought-provoking. They attempted a series of general mass balance calculations with respect to the subduction process. The most significant conclusion was that many element enrichments that occur in subduction-related magmas can only be explained by incorporation of small amounts of the overlying sediments with the subducted slab. Further, in order to form new continental crust through time (particularly relevant to the Archean), it is necessary to delaminate the granodioritic upper crust from the lower mafic crust in arc systems during collision events. This mechanism would be one way of explaining the lack of abundant mafic sequences in preserved areas of lower crustal rocks.

The session on the "Archean Environment" dealt mainly with the early Archean, from 4500-3500 Ma ago. Again, I managed to attend a session where only six of the eight scheduled speakers appeared. Veizer, Laznicka, and Jansen (Ottawa U, U of Manitoba, Carleton U) led off the session with a review of mineralization through geologic time, somewhat reminiscent of the ideas originally put forth by Billibin, but placed into an up-to-date tectonic and isotopic framework. Zahnle, Kasting, McKay and Sleep (Stanford, AMES) followed, and pursued a totally different tack by examining when the earth's surface finally became habitable, using the premise that as long as large (500 km +) bolides capable of vapourizing the oceans were hitting the earth, life could not become established. They estimated that at roughly 3500 Ma, life was able to finally develop without fear of being totally devastated by the next passing asteroid. Lowe (Louisiana State U) and Beukes and Lowe (Rand U and Louisiana State U) described two studies of carbonate rocks of roughly 3500-3000 Ma age in the Barberton Mountainland of South Africa. Lowe described some unusual glass spherule beds interlayered with 3500 Ma carbonates which appear to represent glass spherules deposited from distal bolide impacts. Beukes and Lowe then described a paleoenvironmental interpretation of this part of the early crust based on studies of 3000 Ma stromatolites in the Pongola Supergroup. They noted that chertification took place in these rocks at a very early diagenetic stage due to high silica concentrations in the environment. A similar mechanism may account for the widespread silicification of stromatolites in the Grenville Province. Buick (Harvard U) reported on a well-preserved sedimentary section in the *ca.* 3500 Ma Warrawoona Group from Western Australia, rich in microfossils. The session ended with Kevin Burke (LPI, Houston) who contended that the Archean atmosphere may have been far more oxygen-rich than previously believed. Further, he suggested that carbonates were also much more abundant in the Archean, however, they have not been well preserved in the sedimentary record, mainly because they were deposited as fringing reefs to volcanic islands rather than on continental platforms.

The session on "International Geochemical Mapping" organized by A.G. Darnley (Geological Survey of Canada (GSC), Ottawa) was a prelude to the organizational meetings held at the conference for IGCP Project 259 on International Geochemical Mapping. All eight presentations illustrated how regional geochemical mapping has come of age, and its utility in mineral exploration and environmental studies. In particular, Plant, Forest, Green, Smith, and Williams (British Geological Survey) showed that when integrated with other geophysical and remote-sensing data, regional geochemical surveys could provide a wealth of geologic information. Of great interest was the ability to distinguish specific plutonic suites, and to delineate boundaries between major geologic terranes. Duval (USGS, Reston) showed that airborne gamma-ray spectrometric data could be used in the same way as lake sediment and other geochemical data, and just as effectively. Bolviken (Geological Survey of Norway), in several presentations, illustrated several uses of regional geochemical data in Fennoscandia. Xuejing (China) reported on the difficulties of conducting gechemical surveys in China, but in doing so also illustrated the potential of the method, particularly in areas of poor access and limited mapping.

The platinum group elements (PGE) were the subject of a number of presentations. Page (USGS, Menlo Park), in a keynote paper, spoke of the complex geochemical behavior of the PGE, and that PGE enrichments might be expected a number of unconventional settings, for example, porphyry copper deposits, and sediment-hosted copper deposits. The PGE sessions were well represented by Canadian researchers (7/17 papers). Scoates, Schwann, and Eckstrand (GSC, Ottawa; Carleton U) described the geochemical patterns associated with PGE mineralized units in the Fox River Sill. Roger Eckstrand (GSC, Ottawa) also presented a paper in which he suggested that Se/S ratios may be a useful indicator of PGE potential in mafic intrusions. Along similar lines, Sarah-Jane Barnes (U Québec, Chicoutimi) reported that plots of Ni/Pd *versus* Cu/Ir were useful in distinguishing the effects of partial melting, crystal fractionation and sulphide segregation in magmatic intrusions. A.J. Naldrett (U of Toronto) discussed PGE variations in chromitites, and illustrated that the sulphide saturation curve in a magma influenced whether chromitites were PGE-poor or PGE-enriched. A.D. Paktunc (GSC, Ottawa) presented new data of PGE in association with Ni-Cu sulphide occurrences in the Canadian Appalachians. Brugmann,

Gorton, and Hancock (U of Toronto) described a new analytical method using the SLOWPOKE reactor that allows for the simultaneous determination of Au, Pd, Pt, Ir, Os, and Ru. Hall, Pelchat, and Dunn (GSC, Ottawa) report on the use of ICP-Mass Spectrometry to determine Au, Pt and Pd in water and vegetation ashes, allowing for regional geochemical exploration for PGE.

The general sessions also contained their share of interesting and provocative talks. Hill and Campbell (Australian National U) gave two papers on the use of isotopes in the study of mineralization and crustal evolution in the Pilbara Block in western Australia. The timing of mineralization of lode gold deposits in this area is strikingly similar to that found in the Superior Province as described by Colvine and others at the Ontario Geological Survey. Duane and Clendenin (U of Witwatersrand) presented a strong case showing that the release of fluids from sedimentary basins during continental collision events may be responsible for major metallogenic belts, such as the distribution of carbonate-hosted zinc deposits (Mississippi Valley Type) in eastern North America, especially where fluid flow is focussed by major lineaments. Their work provides a broad plate scenario for looking at metallogenesis related to specific orogenic events, and this type of analysis may prove very useful in regional metallogenic studies. Kathleen Garland (Pennsylvania State U) in her examination of metavolcanic rocks from an alpine olistolith reported the presence of both MORB and alkalic magmatic rocks and interpreted their current juxtaposition as being due to derivation from two source areas during the same depositional event. Of greatest interest to me was the fact that in this case, other geologic evidence was available in this relatively recent orogenic belt to decipher the geologic history, whereas in an older orogenic belt, interpretation of these results would be considerably more difficult.

No geochemical conference would be complete without the introduction of new geochemical plots for showing the interrelationships of various elements. Wilson, Long, and Vogel (Michigan State U) suggested that the first row transition elements (FRTE) (Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Pb) could be utilized in a manner similar to the rare earth elements (REE) for characterizing geologic processes and environments. Although their results looked encouraging, only time will tell if FRTE plots will become commonplace in geochemistry and igneous petrology. In a talk by McLemore (New Mexico Bureau of Mines and Mineral Resources) on carbonatites, a plot of apatite-magnetite-carbonate was used to successfully classify various carbonatitic rocks, suggesting that a plot of P-Sr/Fe/Ca may be a useful plot for alkaline rocks. Several papers dealt with the use of multivariate statistical methods in geochemistry. Kopp, McKinney, and Harris (U of Tennessee and Oak Ridge Laboratory) used principal component methods to classify coals, noting that there were problems with the current ASTM classification of coals. Busek, Anderson and Saucy (Arizona State U) used factor and cluster analysis to distinguish between anthropogenic and natural particles in a study of airborne pollutants. Grunsky, Easton, Thurston, Jensen, and Howe (Ontario Geological Survey) used correspondence and dynamic cluster methods to discriminate different suites of Archean volcanic rocks. The versatility of these methods is apparent by their usage in solving a wide variety of classification problems, however, it is in the areas of environmental and organic geochemistry that they are being most actively pursued, despite their applicability to many petrologic problems.

Also as part of the meeting was the first Ingerson Distinguished Lecture of the International Association of Geochemistry and Cosmochemistry. Professor A.E. Ringwood of Australian National University (ANU) was an apt choice as the first Ingerson lecturer, since his studies of the earth's mantle integrate to both geo- and cosmochemistry. His lecture on "The Composition and Evolution of the Earth's Mantle" provided a review of the latest experimental petrology work by Professor Ringwood and his colleagues at ANU, with emphasis on phase changes that occur with depth in mantle materials, particularly Ca- and Mg-pervoskites. Some of this material will be published latter this year in *Earth and Planetary Science Letters*. It was Professor Ringwood's contention that the upper and lower mantle are similar in bulk composition, and that full scale mantle convection does not occur. This is because a number of important density changes occur at or near the 650 km seismic discontinuity. The effect of these density changes is to make it exceedingly difficult for subducting oceanic crust to penetrate into the lower mantle. In the case of young, hot oceanic crust (also Archean oceanic crust), the result is that the subducting slab reaches the 650 km and spreads laterally along the boundary forming a massive sill-like body. In the case of older, colder oceanic crust, and abnormally thick crust, the subducting slab impacts into the boundary, creating a melange of subducted slab and mantle material (a "megalith"). As the slab continues to subduct, the megalith grows. Both processes result in concentrations of compositionally distinct mantle materials, and account for the large scale chemical heterogeneities that have been observed in the mantle.

The only disappointing aspect of the conference was the large number of no shows. In some sessions, up to one-third of the scheduled speakers were absent, and in most cases, the only indication that a talk was cancelled was when the speaker failed to appear. There are many reasons why a speaker may not be able to attend, but few of these are so pressing that the conference organizers cannot be notified beforehand, and provisions made in the program. The situation was far worse for the poster session; only 60 percent of the scheduled posters were displayed, and many of those displayed were not manned, and of generally poor quality. I am a strong believer in the utility of poster sessions in displaying certain types of data, but it is poster sessions such as this one that perpetuate the myth that poster sessions are for second-rate material.

For the most part, the organizers and sponsors can be congratulated with initiating what may prove ultimately to be a very useful series of conferences. Geochemistry is no longer as much a separate science or sub-science of geology, as it is an important tool in the biological, environmental, planetary and geological sciences, and mineral exploration. Conferences which allow these various groups to interact and exchange ideas and analytical advances are extremely valuable, and are likely to become increasingly so.

Finally, although this was the first V.M. Goldschmidt Conference, it will not be the last. It is the intent of the sponsoring societies that this be the first in a continuing series of conferences to be held in the spring, alternating between North America in even numbered years and in Europe in odd numbered years. As of this writing, the venue of the next V.M. Goldschmidt Conference had not been set.

Copies of the Abstract Volume are available at a cost of $15 US from H.L. Barnes, General Chairman, Goldschmidt Conference, Pennsylvania State University, University Park, PA, USA 16802.