

European Petroleum Exploration — Impressions

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Woodlark Basin, barite chimneys contain significant mineral assemblages, but black smokers, the H_2S that supports deep chemo-synthetic life, and hence the life, are absent.

In the metamorphic session, Sam Gichile (Ottawa) described the structural and metamorphic history of the Proterozoic Mozambique orogenic belt in East Africa. Most of the deformation in the belt occurred between 800 Ma and 700 Ma, and involved massive overthrusting and crustal thickening in a Himalayan-type orogeny. Keynote speaker Alan Dickin (McMaster) summarized the tectonic history of "Cottage Country" (a.k.a. the Grenville), Ontario. Based upon Nd model and Pb/Pb ages, he feels that two island arcs were added to the southern edge of the Superior craton at 1900 Ma and 1400 Ma, while plutonism occurred at 1700 Ma and 1450 Ma. A wide passive margin lasted from 1400 Ma to 1250 Ma, and was then rifted. Another island arc was added at 1100 Ma, followed by continent-continent collision at 1000 Ma.

After lunch, keynote speaker Michael Dence (Royal Society of Canada) gave a detailed tour of some impact craters on Earth, Io, Gannymede, Mars, Venus, the Moon and other satellites. He showed that few impact structures are obvious on Io, which has active volcanism, whereas impacts abound on Gannymede and Venus, which have no recent volcanism. Crustal material in the larger craters is forced as much as 20-30 km deep, then brought back to the surface within a few seconds, causing the central cones to form with much more metamorphosed, shattered rocks. James Tremblay ended the oral sessions by thanking the participants and organizing committee.

Several posters were also presented. Holding the poster sessions in the same room as coffee and lunch breaks ensured that most people read the posters, while the coffee, doughnuts, sandwiches and pastries fuelled the discussions. Tamie Weaver *et al.* (Waterloo) discussed the groundwater chemistry of the Devonian oil wells in southern Ontario, while Bob Drimmie *et al.* (Waterloo) described the isotopic signatures of sedimentary paleowater in the Lake Ontario and Lake Erie basins. Jessie Stimson *et al.* (Waterloo) detailed the isotopic evolution of groundwater in the Cochabamba Basin in Bolivia. Dolores Durant and Paul Clifford (McMaster) showed how they used crystal size distributions to determine nucleation rates and densities in syenites from Spanish Peaks, Colorado. Bonnie Blackwell *et al.* (McMaster) described how they dated Sanganian kettle deposits at Hopwood Farm in Illinois by using electron spin resonance to date tooth enamel and fish scales. Bruce Ainsworth (McMaster), with S. Crowley, described transgressive strand plain sediment from the Upper Carboniferous in the United Kingdom. Bonnie Blackwell *et al.* showed how fossilization occurs in bones deposited in hypersaline lakes in Australia and

Saskatchewan. Alan Dickin (McMaster) detailed his work in progress using various isotopic systems, including Sm/Nd, Pb/Pb, U/Pb and Re/Os.

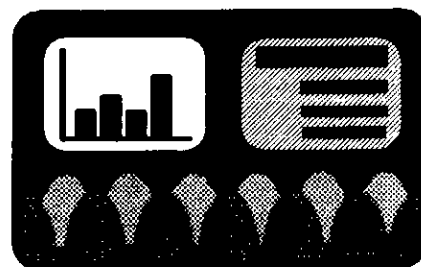
This year's presentations were extremely well done. The quality of slides and overheads far exceeded that seen at many national and international meetings. Unfortunately, microphones were not available: they would have been a real bonus for several soft-spoken speakers. Scientifically, all the data presented was of the highest calibre. This made it difficult for the judges to select the winning papers. Uwe Brand (Brock) judged for the GAC; Derek Armstrong (OGS), for the CSPG and Charles Gamba (McMaster), for the CIMM. Michael Gipp won the GAC trophy for the best talk, with David Bethune as runner-up. The GAC trophy for best poster went to Bruce Ainsworth, with Jessie Stimson as runner-up. The winner of the CSPG trophy for best paper was Carlos Bruhn, with Bruce Ainsworth and Christine Brophy as runners-up. The CIMM award went to Alex Langshur, with Debra MacDonald as runner-up.

The only complaint I have with the student speakers is that there were so few. This is an excellent opportunity to "test-market" a paper before presenting it at a national meeting, but very few students took advantage of it. Granted, the fact that not all Ontario universities have the same reading week makes it difficult to select an optimal time to suit everyone. This hampered attendance by both speakers and others. One way that attendance could be increased would be to insist that all graduate students from the host university present talks or posters.

Although the program frequently ran behind time, this did not prove problematic, because only one session was running. It did mean that some speakers could present more detail than would normally be possible, as well as leaving more time for questions. It would, however, have been nice if the first sessions had begun on time each day. Unlike some small conferences, technical services were good, except for the lack of microphones. Certainly, the organizers provided ample food and refreshments. Congratulations must go to the McMaster students who organized the conference. I think it proved valuable for all who attended. Considering that each year's group must start from scratch to organize the event, it is a daunting task. The CCGC needs to build a handbook giving hints on how to plan and run such an event.

Waterloo will host next year's Central Canada Geological Conference, during their reading week. Anyone wishing to attend, or to present talks or posters, should contact the Department of Earth Sciences, University of Waterloo, Waterloo, Ontario N2L 3G1 for more information.

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The European Association of Exploration Geophysicists and the European Association of Petroleum Geoscientists joined forces for, respectively, their 53rd and 3rd meetings at the Fortezza de Basso in Florence, Italy, from May 26 to May 30, 1991. Fifteenth-century battlements enclose what has been converted into a spacious modern conference centre, about one kilometre northwest of the old city.

The conference centre has excellent facilities for exhibitors. They took up the lion's share of the space, pushing lecture theatres to curtained-off corners or into adjacent buildings. It was clearly their show, and most of the 157 listed exhibitors were geophysical contractors. What they had to offer was impressive, especially in the field of reflection seismic data processing. Banks of monitors relayed vivid images of 3-D seismic surveys. They projected horizon maps, slice maps, hydrocarbon anomalies, reservoir character maps and incredibly detailed structural profiles, plus all kinds of graphic displays of vertical seismic profiling. Work stations proliferated, with hands on involvement by delegates encouraged. Companies like Halliburton and Schlumberger gave walk-in courses on their new software. Interactive cross-section modelling, data management systems, geochemical synthesis, computerized drafting; if it could be programmed, it was on show. Beside all this megabyte technocracy, the drilling company stands with their pipe and bits and the publishers with their book-laden shelves and tables looked very staid. Clearly, this was one trade show that geophysical contractors active in Europe took very seriously. US companies were particularly prominent, both in terms of the level of their participation and the sophistication of their exhibits. From the examples of previous work that they showed, they are clearly

major players in the European theatre and intend to remain so. Canadian involvement was insignificant. A mere eight companies exhibited. Of the eight, only Tecnica and Hampson-Russell have well-established international profiles, but it was encouraging to see a small company like Digi-Rule seeking European business.

Although mining geophysics was represented, the overwhelming emphasis at the EAEG-EAPG Conference was hydrocarbon exploration and production. Several themes emerged. It was apparent that a great deal of contracted applied geoscience is being performed in Europe by joint-venture teams involving exploration companies, national organizations, research institutes, consulting groups and universities. These profitable "ententes cordiales" have not arisen overnight, and their growth has been spawned by different factors in different places. In the UK, decreases in government funding forced university researchers to look elsewhere and to focus graduate theses and faculty research on work for which the private sector would pay. Funding cuts have also affected the British Geological Survey, which was actively marketing in Florence its geophysical expertise. Sensitive of being seen to undercut private companies, the BGS is seeking joint ventures in partnership with other contractors. In Norway, holders of offshore hydrocarbon exploration permits were obliged to direct monies to Norwegian-based research. A number of more or less publically supported research institutes sprang up to harvest this bounty, much as occurred in the 1970s and early 1980s in Newfoundland. Initially, their contributions were not always state-of-the-art, but, as offshore development has proceeded and production blossomed, the policy has borne fruit. Today, the onshore research performed by Norwegian research institutes and universities has grown into a technically sophisticated, significant and valued arm of the international oil industry. In France, co-operative ventures among federal research institutes, universities and oil companies have been well entrenched for years. There is a tacit understanding of the mutual dependence among the different sectors which is a definite stimulus when compared to the North American reluctance to share information and insights with outside organizations.

Much of the technical material presented at the conference concerned rock anisotropy. It is finally becoming recognized that most sedimentary rocks vary laterally as well as vertically, and that there may be hydrocarbon production to be gained from a knowledge of their fabric. This is particularly true if the rocks are fractured. Finding and quantifying fracture networks has rightly become a major obsession. Fractured rocks split shear waves that pass through them, and much industry-sponsored research is underway aimed at harnessing this property

to characterize reservoirs. The British Geological Survey's Anisotropy Project has drawn support from nine major oil companies and Stuart Crampin reported on recent results. Theoretical work and case studies are underway and, while shear wave splitting has much promise, there appear to be considerable problems in processing signals and obtaining unique interpretations. Another aspect of reservoir anisotropy concerns what can be "seen" in well-bores. Digital acoustic borehole televiewers are now available, with sensitive interactive software for data processing and interpretation. The multiple resistivity sensor pads of formation microscanners give a lower focus image, but these tools can be raised up wells at higher logging speeds than BHTVs, and are cheaper to run. The FMS is all the rage for fracture mapping and downhole sedimentology. Lateral sonic anisotropy of rock bodies is also being revealed by 3-D seismic processing and the resulting map configurations are being calibrated against log and well data. Images of pool size criteria and production-sensitive parameters show an awesome level of detail that is cutting across structures can be mapped, and the hydrocarbon saturation within them semi-quantified.

The winds of change sweeping across Eastern Europe have reached the oil industry as well, and concessions are now available in many of the former Soviet satellites. Countries like Hungary, Czechoslovakia, Romania, Bulgaria, Yugoslavia, Albania, Poland and the former East Germany have received little serious exploration scrutiny over the past 50 years. As W. Kreuger emphasized, there are likely to be many excellent undrilled prospects waiting to be mapped and tested at competitive cost. What is needed are investment, new concepts, modern technology and deeper drilling. Most of the prospective areas are open for profit-sharing joint ventures, and all the countries are ready to encourage rapid development. Eastern Europe may well be the new exploration frontier for the 1990s, and investments there are likely to replace exploration activities in other parts of the world. Canadian companies should seriously consider becoming involved.

Finally, the dominant influence of reflection seismology on petroleum exploration was vividly illustrated by the large number of posters, papers and exhibits devoted to data acquisition, processing, velocity analysis and modelling. Organic geochemistry is becoming ever more linked to numerical modelling, and kinematic modelling is enjoying a renaissance. The Institut Français du Pétrole showed a stimulating video of a foreland thrusting model that had been x-rayed CAT-scan style while it was being mechanically deformed. Seismic stratigraphy and Vail curves are still very much in vogue, although John Underhill questioned whether some of EXXON's Late Jurassic onlap/offlap cycles were really caused by sea-level changes.

The 1991 EAEG-EAPG Conference was an expansively presented, well-planned meeting with much to see and hear and not an overwhelming number of delegates to hinder one's movements. Perhaps, this was due to the call of Michelangelo and Botticelli, but it may also have been partly a consequence of the registration fee (\$400) and the high prices for room and board in Florence.

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