

Exploration Update 79

J. S. Bell

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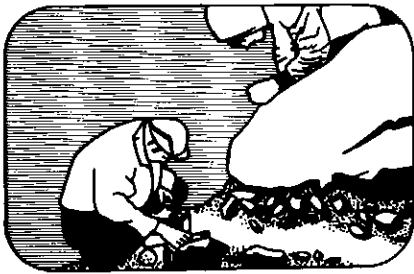
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Conference Reports



Exploration Update '79

J.S. Bell
BP Exploration
Canada Ltd.
333 - 5th Avenue S. W.
Calgary, Alberta T2P 3B6

"Exploration Update '79", as the title admitted, was a conference aimed at updating explorationists of the oil industry. Jointly sponsored by the Canadian Society of Petroleum Geologists and the Canadian Society of Exploration Geophysicists, it was held at the Calgary Convention Centre from June 10th to June 13th, 1979, under the co-chairmanship of Neil Hutton and Easton Wren.

By all conventional measures, the conference was a great success. It attracted nearly 1900 paid registrants, some 200 more than last year's highly publicised "Principles of World Oil Occurrence" symposium, and at least 60 exhibitors presented their wares and services. Moreover, it netted a record profit. And yet, in three days, only 42 papers were presented and many of them relayed much information which had already been made public. It was clear that the CSPG and the SCEG had found it difficult to attract speakers. This is hardly surprising, since both societies present a heavy schedule of

lunch-time talks throughout the year and had obviously depleted their regular suppliers in the process. Indeed, this reviewer wondered if science might have been better served had they merely fattened their midday programs rather than hosting a conference at all. Science might have benefited, but not the exploration community.

Right now, the Canadian oil industry is like noodle soup on the boil. Geologists and geophysicists are entering the industry, changing jobs and accepting transfers in ever increasing numbers. They work in all sorts of settings, as the traditional highroads of apprenticeship are being abandoned for logging trails with overrides and flyovers supported by stock options. No longer are most industry personnel processed by the major oil companies and tattooed with state-of-the-art insights at their research laboratories. In today's heady boom, explorationists have to find their feet quickly, they constantly need to breathe the winds of change and so companies, large and small, register their staff for conventions to increase their experience and augment their training. Exploration Update '79 should be assessed in this context, as a sort of technical briefing for stimulating and informing busy people, rather than as a gathering assembled to roll back the frontiers of knowledge.

The first day's program contained eight keynote addresses. Mike Halbouty launched the proceedings with an updated version of his well known pep talk on finding giant oil and gas fields. Since these were defined, respectively, as containing in excess of 100 million barrels of oil or one trillion cubic feet of gas, a review of the past decade's achievements gave cause for

apparent encouragement, but Halbouty emphasised that even greater efforts were now required. Recent Egyptian discoveries offshore in the Gulf of Suez were then described by A.S. Abdine. Although the major reservoir there is the pre-Tertiary Nubian Sandstone, the oil in it is believed to have originated in Miocene shales. Peter Vail followed with a rapid seismostratigraphic Cook's tour over the ground covered in AAPG Memoir 26, while, in the final talk of the morning T.R. Eck presented his view of the North American Energy Outlook for the 1980s. Like most commentators, he anticipated continued heavy reliance on oil, expected future supply problems from the Middle East and felt that a "solution" involving diminished OPEC imports, conservation and access to Canadian and Mexican oil could be envisaged. An icy silence greeted a comment from the floor that the OPEC supply could be increased "if the United States changes its foreign policy."

Monday afternoon belonged to Western Canada and its recent discoveries. Gerry Henderson (Chevron Standard) described the oil-bearing Devonian pinnacle reefs of West Pembina. They are small in area and only attain heights of about 110 m. For this reason, their recognition requires high resolution seismic data on which they exhibit a subtle but distinctive signature involving amplitude change and uplift. Reservoir quality is a variable function of primary porosity, diagenetic replacement and dissolution as well as local fracturing, while geochemical studies indicate that the oil was probably sourced by adjacent Nisku shales. David Martin (Amoco) discussed his company's exploration for shallow gas in the Primrose Lake area of Northeastern

Alberta, where exploration in the 1970s has found more than 1.5 trillion cubic feet of gas in Lower Cretaceous sands draped over salt solution edges. This was followed by a paper on the Sukunka-Bullmoose gas trend in northeastern British Columbia presented by Davo Barss (BP Canada). Here, sour gas accumulations have been found in fractured Triassic reservoirs atop intricately imbricated thrust wedges. To complicate matters further, rugged topography hampers acquisition of seismic data and places great restrictions on where wells can be drilled. Fortunately, improved technology and rising gas prices have sustained continued exploration. The final talk of the afternoon was delivered by John Masters (Canada Hunter). Speaking with great force and fervour he essentially repeated his familiar, and now twice published, assessment of the Deep Basin. Recently, Canadian Hunter's estimates of 150 trillion feet of recoverable gas at \$2.00/mcf net return have been shrivelled more than one hundredfold by the National Energy Board. To applause and appreciative laughter, Masters suggested that the NEB was very similar to the old French generals, all ready to fight World War I when World War II hit them. Further volleys were fired as he reasonably pointed out that Arctic gas reserve estimates based on data from 25 wells were accepted by the National Energy Board, whereas there were hundreds of wells with which to evaluate the admittedly unconventional reserves of the Deep Basin. Clearly, the question of how much producible gas is there will not go away and, equally determining how much gas Canada can offer to export to the United States during the remainder of this century.

Tuesday brought two concurrent technical sessions in which 27 papers were presented. Much interest was focussed on two papers presented by Brian McLean, Robin Falconer and Eric Levy (Bedford Institute of Oceanography) on the Baffin Bay oil slicks. Studies indicate that natural crude oil is continuously seeping from glacially eroded tilted strata around Scott Inlet, Buchan Gulf and other localities in Northern Baffin Bay. Petro-Canada recently bought permits covering some of the possible seeps, but most of the

acreage has not yet been awarded to any exploration companies. Onshore of one oil slick zone lie the attractive Tertiary sandstone reservoirs of Bylot Island discussed by Don Daac (Norlands Petroleum). If similar facies are present offshore in Lancaster Sound or Baffin Bay and are adjacent to mature source rocks, prolific hydrocarbon accumulations could exist. Exploration of any fields in such ice-infested environments will be a gigantic technical challenge. Gordon Jones suggested it will be met by drilling from artificially thickened floating ice-sheets, as has been pioneered in the Arctic, as well as through the continued use of dynamically-positioned drillships which can evade icebergs. Moving to another hostile Frontier area, Peter Jones (Dome Petroleum) described recent successes in the Beaufort Sea. As previous publications and talks have suggested, traps are related to shale-cored anticlines and growth faults. Tertiary sands are present far out into the Beaufort Basin, and various environments for their deposition are inferred, with some reservoirs being interpreted as turbidite deposits.

Returning to the Deep Basin, David Smith and Dick Wyman (Canadian Hunter) filled in details of the Elsworth Falher gas trend. Using the Nile Delta as an analogue, the productive Falher conglomerates were interpreted as beach deposits fronting a channelled delta plain. Permeabilities of these conglomerates and associated sandstones range from 1000 md to under 0.001 md and their productive potential can only be assessed through combined appraisal of logs, cores and tests. Smith suggested that, if all reservoirs with porosities exceeding seven per cent are productive, recoverable gas from Elsworth alone amounts to 42 trillion cubic feet.

Devonian carbonates always crop up at CSPG conferences. They also crop out in the Rockies, and Bob Workum described surface equivalents of the West Pembina sequences, while Frank Stoakes plunged into the subsurface to unravel Ireton and Nisku depositional cycles. According to Stoakes, log markers in Ireton shales delineate inclined accretionary surfaces and he recognised five coexisting

paleoenvironments tied to paleobathymetry along one marker horizon. The markers were thought to represent log response to sequences starved of terrigenous detritus during sea level rises, and the West Pembina patch reefs themselves appeared to be stacked successively basinwards. Later, Uli Wissner (Union Oil) described the gas-bearing Slave Point patch reefs of northeastern British Columbia and suggested that many of them may be separated by former surge channels.

Seismic technology dominated the Geophysics Session with R. W. Huntley (Seiscan-Delta) providing an opening review of the current state of the processing art. Today's geophysicist can call on improved filtering techniques, better migration and automatic statics corrections. In addition, as Marion Bone (G.S.I.) emphasised, 3-D seismic technology can throw new light on complex subsurface configurations. John Berryhill (Exxon) then discussed the advantages of ray-path modelling with respect to its ability to determine travel times and so predict the reflection geometry of a given structural configuration. Other talks discussed S waves, the Ontario reefs, electrical sounding for them, and the Peace River Oil Sands.

The final morning was devoted to interdisciplinary topics and included an excellent update of recent Alberta exploration legislation by Mike Day, the Assistant Deputy Minister. Day noted that recent policies had been aimed at increasing exploration through faster turnover of oil and gas rights and promotion of deep plays. Although other factors, such as pricing and success ratios, have contributed to the current high level of activity, he felt that the changes had been effective. They have certainly contributed to land price hikes and have influenced company strategies, which led Jim O'Byrne (Quintana) to discuss some of the more imaginative farm-out deals that could be employed to acquire interests in prospective acreage.

All the topics discussed over the three days shared one common element: the personnel to do the job, so it was most appropriate to end the conference discussing the training of petroleum geologists. In a talk which

will rarely be matched for its realism, perception and judgement, Andy Baillie pinpointed the pitfalls of prosperity. Effective petroleum geologists today have to synthesise a vast amount of data much of which is indirectly derived. This requires experience and judgement considerably beyond what is now acquired in B.Sc. programs. In Universities, curriculum changes to capitalise on recent advances have been made at the cost of basic science and interdisciplinary courses, so that the emerging undergraduate tends to be a successful listener and exam passer rather than the possessor of well developed analytical capabilities. Entry to industrial exploration at the M.Sc level is much more desirable, but the buoyant job market pulls most geology students out of University with only B.Sc.s. Baillie did not see signs of improvement on the horizon. Few University professors have much experience in the oil industry so there is little federal funding for petroleum oriented research, field experience is on the wane, and no initiative is being taken to effect transfer of personnel through senior industrial fellowships, added to which even company courses these days do not emphasise problem solving. Thus, in a conference which opened with Halbouty's call for Initiative, the closing talk forecast an intellectual drought.

The final afternoon was devoted to AAPG-style workshop sessions on drillsteam testing, sandstone diagenesis, gravity and magnetic surveying and seismic modelling. All were well attended, as was the nostalgic display of historical photos which chronicled the history of hydrocarbon exploration in Canada. In retrospect, this reviewer feels that the papers presented at "Exploration Update '79" revealed no major insights or significant technical breakthroughs, but they did provide a useful overview of Canadian oil industry activity and gave glimpses of what may lie ahead.

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Early Precambrian Volcanology and Sedimentology in the Light of The Recent

E. Dimroth

*Département de Géologie
Université du Québec à Chicoutimi
Chicoutimi, Québec G7H 2B1*

The first meeting of IGCP Project 160: Precambrian Exogenic Processes, was held in Quebec City (May 23-25, 1979) during the annual meeting of the Geological Association of Canada. This was the first symposium entirely devoted to the physical volcanology and sedimentology of the Early Precambrian, a subject of research that has long been neglected but where now rapid and significant progress is being achieved. The objective of the symposium was to present models of Archean volcanism and sedimentation in the light of Holocene analogs. In order to stress the uniformitarian approach of the symposium, most major subjects were introduced by a speaker who synthesized relations in the Holocene, followed by speakers describing relations in the Archean and Proterozoic. The symposium documented significant progress in several fields, and only its highlights, not the whole program, will be discussed below.

In the first morning, Gary Wells, Michael Jackson, Laszlo Imreh, Erich Dimroth and A. F. de Rosen-Spence developed models of the flow of mafic and acidic lavas under the sea and the resulting distribution of facies (pillowed lava, massive lava, flow beccias) within flow and eruption units. These models are based on detailed mapping of the facies distribution of Archean subaqueous flows and on their

interpretation in the light of lava flows observed at the shore-line of Hawaii. The models now permit us to reconstruct the paleogeographic evolution of Archean volcanic terrains.

Facies analysis of pyroclastic rocks should also add significantly to our knowledge of the paleogeographic evolution of Archean volcanic sequences. This session was introduced by a lucid account of Holocene submarine pyroclastic rocks (Hans-Ulrich Schmincke). Pyroclastic rocks are particularly significant in the last stage of the growth of some Archean volcanic complexes, when volcanic islands formed. Phil Thurston, Lorne Ayres, and Bill Padgham described subaerial pyroclastic rocks from several localities in Canada.

Paul Robinson then discussed the low temperature alteration of ocean floor basalts. Generally speaking, one can distinguish a pervasive alteration and an alteration related to primary porosity (fractures, inter-pillow spaces, inter-particle porosity, vesicles). The latter type of alteration takes place at strongly oxidizing conditions and results in strong chemical exchange between sea water and the volcanic rock. Dimroth then summarized the relict textures in Archean basalts and rhyolites due to sea-flow alteration.

Discussion of Archean sedimentary environments followed (Roger Walker, Michel Rocheleau, John Wood, Roy Shegelski, Ken Erikson, Alan Bailes, Thomas Reimer). Generally, basins are steep-sloped and deposits of high-gradient streams (braided stream, piedmont form) grade directly into turbidites without intervening shelf sediments. In general, the basal sediments are volcanogenic and grade upwards into sediments of volcanic plutonic derivation, thus indicating uplift and erosion of a volcanic source terrain containing shallow level batholiths. Such environments are found in some recent island arcs described by Hakuyu Okada. In some cases, steep-sloped basin margins are transformed into shelf-rise sequences with more usual shelf sequences due to progradation of turbidites (Ken Erikson).

Thus, the margins of the Archean volcanic belts generally appear to be steep and lack a shelf. The few shallow marine sediments which are presently known from the Archean are (in