

## Facts and Principles of World Oil Occurrence

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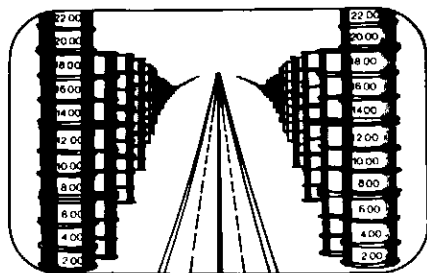
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# Conference Reports



## Facts and Principles of World Oil Occurrence

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The Canadian Society of Petroleum Geologists celebrated their fiftieth anniversary by sponsoring a conference on the "Facts and Principles of World Oil Occurrence". Planning and organisation involved some 70 members of the society whose efforts were co-ordinated by the chairman, Jack Browning. The conference was held in the Convention Centre and Palliser Hotel in Calgary, from June 26 to June 28, 1978, and attracted 2,000 registrants.

It involved two main sessions, one on Facts and the other on Principles, which ran concurrently in adjoining auditoriums at the Convention Centre. Meanwhile, specialist sessions proceeded across the street in the Palliser Hotel, or in smaller rooms in the Convention Centre. Conference field trips visited the Mackenzie Delta, the Alberta Foothills, and the Athabasca Tar Sands. The organisers

envisaged a technical gathering with a similar impact to the AAPG's 1955 Habitat of Oil Symposium, and invited established authorities to present talks on topics of demonstrated geological and geophysical significance to the petroleum industry. As a result, we heard many superbly illustrated and delivered talks, but there were one or two cases of "experts" replaying the same old tunes that had established them as authorities many years previously. It is very difficult to choose speakers who can give incisive up-to-date appraisals of progress, and particularly so in the oil industry. In the first place, really significant recent advances are rarely deliberately revealed in public; secondly, successful petroleum geologists who may once have had "something to say" often advance into management positions and lose their frontline perspectives and, thirdly, real progress usually occurs at grass roots levels far from the limelight through the efforts of initially unknown scientists. Nevertheless, this was a most stimulating gathering with more than enough for everyone.

In the keynote address, His Excellency Sheikh Yamani, Minister of Petroleum and Natural Resources for Saudi Arabia, spoke of the possible consequences of the impending oil shortage with a blend of eloquence and statesmanship. Ahead of us was a short term period of oversupply, which might last until early 1980, and it would be followed by a period of balanced supply and demand. This balanced situation was likely to continue as long as the production capacity of OPEC countries permitted, but by 1988-1990, a serious shortfall was anticipated.

Facing south as he spoke, Sheikh Yamani observed that recent inflation

had curbed and even reversed growth in OPEC countries during a period when the industrialised nations had increased their wealth. OPEC member countries, he said, were entitled to achieve growth at a higher pace than that enjoyed by their main customers. For them to do so, prices should not be artificially depressed during the current period of oversupply, and their oil revenues should be permitted to grow gradually in real terms throughout the rest of this century. If this did not occur, Yamani warned, OPEC would impose another sharp increase in the late 1980s at the onset of the supply shortfall.

Later, M.A. Adelman of MIT acknowledged that OPEC could raise oil prices without significantly diminishing sales, but suggested that there would be gradual price increases over the next few years. A lot depended, of course, on the results of exploration and Keith Huff reviewed past experience in frontier areas. He showed that, so far, much more oil has been found onshore than offshore. Not that offshore areas may not be prolific, despite early discouragement. To illustrate this point, Sir Peter Kent cited the case of the North Sea where the surrounding onshore geology barely hinted at either its structure or its oil riches. Even after gas fields had been found in the southern North Sea, 46 dry holes were drilled before an oil field was found in the northern basin.

In the final keynote speech, Marshall Cohen, Deputy Minister of Energy, Mines and Resources, discussed the difficulties in setting government policies for the exploration and development of oil and gas resources in Canada. He seemed to feel that a perfect energy policy was the key to future Canadian prosperity, while regretting that current reserve

estimates were insufficiently accurate to permit one to be formulated.

Cohen's formula for dealing with this uncertainty involved: (a) not taking big risks in setting policy, (b) moving to eliminate the uncertainty through exploration, development and research, (c) risk sharing, and (d) flexibility. What he did not question was whether the massive federal efforts at resource reserve estimation need be pursued at their current levels of detail and intensity before sensible government policy can emerge.

The first day's proceedings concluded with a dinner at which Anthony Sampson spoke of the poor image of the oil industry, and criticised the major companies' efforts at public relations. Emphasising their importance and size, while artificially closing ranks in their official pronouncements, was hardly an effective way to reassure a public who wondered where their loyalties really lay and distrusted their "obscene profits". It would be far better, Sampson suggested, for the companies to communicate with candour, share their doubts, and tell people that they really were competing with each other. Pointing to the experience of 1911, he argued that the large integrated companies should break up. This would not only help re-establish public confidence, but lead to a surge in exploration activity.

In the following two days, the Facts sessions led listeners all over the world through proven and possible hydrocarbon accumulations. Betty Miller explained how the USGS gave educated guesses statistical respectability, but could not conceal the disappointing results of American offshore activity outside the Gulf Coast. Even there, she forecast that only five billion more barrels awaited the drill. The lack of major oil accumulations on the Scotia Shelf and Grand Banks was attributed to immaturity of possible source rocks, although Pat Purcell conceded that deeply buried distal Jurassic shales might generate oil. Jim Swift later reached the same conclusion for the Grand Banks. The Labrador Sea and West Greenland Mesozoic and Tertiary sections appear to be gas prone, according to Purcell and G. Manderscheid, but in both areas good

reservoirs may be rather limited in extent.

Northwestern Europe evolved logically and rapidly in a paleotectonic "tour de force" orchestrated by Peter Zeigler, who essentially rewrote and expanded L.J. Wills' famous 1952 Paleogeographic Atlas. He set the stage for E.I. Bergsager's analysis of the Norwegian continental shelf, where hydrocarbons have been found in Middle Jurassic sandstones, Maestrichtian chalk and Paleocene turbidites, and for Pierre Burolet's dissection of Mediterranean basins. Malcolm Parsons described the prolific reservoirs associated with structural highs in the Sirte Basin of Libya until, inevitably, the Middle East was examined. Rather than list all the favorable situations and comment on the happy coincidence of their advantageous juxtaposition, R.J. Murriss documented the paleofacies development through time, and presented a Shell carbonate synthesis of the region. In so doing, he made a strong case for the source rocks being deposited in starved basins during transgressive periods.

Hydrocarbon accumulations in Latin America, Asia and Australia were covered in a series of talks led off by Jack Browning, on leave briefly from his chairman's responsibilities. Greatest interest centred on J.C. Garcia's discussion of the recent oil discoveries in the Chaipas – Tabasco region of Mexico. Mike Hriskevich of Aquitaine drew cheers as he took the Government to task for their Canadian exploration policies, but the same audience also applauded comments from the floor on the excellence of exploration opportunities in Canada compared to those in several countries his questioner could name (and did, to more cheers!). After an arcuate geological tour through northern Canada via the possible Dempster lateral pipeline route, a final Bonanza in Texas was presented by Bill Bell who, with understandable enthusiasm, described the discovery and development of the Kurten Field.

The Principles sessions were for the most part less well attended, yet it was here that the tips for picking future winners were being distributed. Seismic stratigraphy is already proving its worth and organic geochemis-

try, after the precocious promise of its youth, is generating particularly sophisticated appraisal tools. Trevor Powell presented empirical evidence that hydrocarbon occurrences do not fit a simple model of oil and gas generation. Many gas occurrences in undermature sections imply that overmaturity is not a prerequisite for its generation. Oil, too, is found in immature environments and in settings suggesting derivation from terrestrial organic debris which, traditionally, has been considered gas-prone. Powell's findings could partially invalidate Bernard Tissot's subsequent claim that most of the Devonian oil in Alberta, such as that at Leduc, was generated in Early Tertiary time, and that there was no widespread Paleozoic maturation. Kinji Magara then discussed how oil probably migrated in its own phase along with compaction water, much as a protesting policeman might be swept along by a crowd. Molecular solubility of oil in water, even at high temperatures, was too low for migration in solution to be effective. Volkmar Schmidt attempted to demonstrate that the development of secondary solution porosity in sandstones was likely to be succeeded almost immediately by hydrocarbon generation. Although his slides clearly brought out the strong textural evidence for secondary porosity, it was less easy to evaluate how well the inferred physical controls were documented.

S.J. Snelson, substituting for A.W. Bally, projected two fascinating deep reflection seismic lines shot in the COCORP program. One traversed a horst block in Wyoming, and showed a marginal reverse fault apparently descending to the Moho. The other, shot in Nevada, showed reflections down to nine seconds which suggested that a range-bounding listric normal fault also cut right through the crust. These seismic lines were, however, merely an hors d'oeuvre. Snelson then showed a movie of Phanerozoic continental drift which he ran forwards and backwards at approximately one million years/seconds. While football and Warren Carey fans enjoyed watching Italy kick Spain in the ribs during the reverse run, a subtle pulse of the earth emerged in the varying rates of drift and the cycles of activity.

Surely understanding the causes of this pulsation must be one of Earth Science's greatest challenges!

Perhaps in this conference hydrodynamic traps finally came of age. Spawned with rigorous diligence by King Hubbert in the early fifties, they have lingered in the background, invoked where unavoidable, but generally avoided. Phillippe Riché described unclosed structural noses in Algeria where 700 million barrels of oil are trapped in Cambrian-Ordovician reservoirs. Later, Darryl Myhr and Nick Meijer-Drees described the Milk River hydrodynamic gas trap.

The biggest bombshell of the Conference, however, was dropped by John Masters of Canadian Hunter in the last talk in the Western Canadian session. His electrifying address lasted over an hour, and he stunned the conference with his assessment of the Deep Basin hydrodynamic trap in Alberta and B.C. In a thick Mesozoic section containing stacked sandstones and conglomerates Masters claimed you could not drill a dry hole, only a non-commercial one. All reservoirs below 3,500 feet in this area were gas-saturated and many intervals could be completed to flow successfully at economic rates. There was no conventional structural or stratigraphic trap holding this gas in place, it had to be hydrodynamic. Ultimate reserves were gigantic, probably several times the present known gas reserves in all of Canada, and the field could well be the largest in North America. In fact, these resources were so great that they had to influence profoundly Canada's future energy policies. The impact of Master's revelations dominated the conference, pushed policies off the front pages, and even stilled lobby discussion of West Pembina.

In between these highlights smaller groups of delegates attended geomathematics, paleontology and geochemistry sessions while, in the adjacent Glenbow Theatre, Hal Cummings had assembled an enticing program of films. It was a conference where everyone had to miss a lot that they wanted to hear, and this reviewer has certainly omitted describing many excellent talks. In other words, it succeeded.



## The Status of Geological Engineering

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During May 15 and 16, representatives of the nine university departments teaching geological engineering met as part of the Canadian Conference on Engineering Education at Loyola University in Montreal. For the past several years, courses in geological engineering have had problems in meeting the requirements of the Canadian Accreditation Board of the Canadian Council of Professional Engineers. If a course in engineering is accredited, its graduates may register as Professional Engineers without further examination, and their registration generally may be transferred across Canada and to the USA. A particular stimulus for this meeting came from investigate accreditation problems in engineering physics and geological engineering. The committee, consisting of A.D. Moore, Electrical Engineering, University of British Columbia (Chairman); J. Ham, Electrical Engineering, University of Toronto; R.A. Blais, Geological Engineering, Ecole Polytechnique, and J.D. Smith, Mechanical Engineering, SNC/GECO, was to make recommendations to the Canadian Accreditation Board in June, 1978.

In simple terms, the problem is that the Canadian Accreditation Board in its Annual Report of 1977 considers geology to be a pure science, and provides in its standards for curricula

that at least 12 ½ per cent of the curricula must be basic science. Although the time allocated for science is described as a minimum, when the other minimum requirements are taken into account, there remains only another 12 ½ per cent of the curricula unallocated, and this the Board suggests, "should be used to expand the foundations beyond the minimal limits and to build special courses for the various branches of engineering on these foundations". Obviously one cannot train a competent geological engineer under these constraints. At present, departments teaching geological engineering are making some concessions; some geology classes are being considered engineering science, and as a temporary measure the Board is accepting less than full compliance.

The portion of the meeting devoted to geological engineering problems was divided into four sessions. The first, chaired by Marc Tanguay, was devoted to brief presentations and discussion of the role of the geological engineer. Bryan Pryce (Imperial Oil Ltd.) and Kent Murphy (Rousseau Sauvé and Warren Consulting) described the role of the geological engineer in the Petroleum and Civil Engineering fields and stressed the need for geological engineers to be broadly and well trained in geology. Ron Patterson of Queen's University described his experience with the Ontario Government in reviewing geohydrologic proposals, and stressed the importance of competence in stratigraphy for engineers preparing these. Jim Neilson, also of Queen's University, filling in at the last minute, discussed the mining scene.

Roger Blais, in the second session chaired by Bill Brisbin, gave a brief résumé of his assessment of the answers to a questionnaire sent by the Moore Committee to all departments teaching geological engineering. He emphasized the problem of the definition of the geological engineer and geological engineering. The responses he obtained concerning the role of geological engineering were the traditional roles in mining, petroleum and heavy construction industries. Blais felt that modern roles were overlooked and fields such as geolog-