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NATO ADVANCED STUDY INSTITUTE: COMPOSITION, GEOCHEMISTRY AND CONVERSION OF OIL SHALES

The above-mentioned meeting has been held in Akçay, Turkey, on July 18—31, 1993. There were about 100 participants from 16 countries (Australia, Belgium, Canada, Estonia, Germany, Greece, Israel, Italy, Norway, Poland, Russia, Serbia, Spain, Turkey, United Kingdom and USA), 35 reports have been presented and discussed, a poster session (25 papers) organized.

The development of science and technology is one of the important objectives of NATO and it is realized through the NATO Science Committee programmes. Advanced Study Institutes (ASIs) are one of the current activities supported under the NATO Science Programme. The purpose of ASIs is to spread advanced knowledge not yet in universities study plans, and to promote scientific contacts through high level teaching courses. It is a post-doctoral-level teaching activity traditionally lasting 10 days; these meetings usually have about 100 participants and 12 to 15 lecturers among them.

The ASI under review has been organized considering perspective importance of oil shales as a source of energy and liquid fuels. At the same time the scope of problems discussed has not been restricted by applied science subject matters, and a considerable attention has been given to academic research. Environmental aspects were discussed in connection with various problems but, though it is a good form nowadays, they were not placed in the forefront.

The papers presented can be roughly divided into the following groups: characterization of various oil shale deposits, geochemistry, analytical methods, and processing of shales. Some more interesting, to my mind, results and viewpoints put forward at the meeting are as follows.

As to the characteristics of oil shale deposits the material presented was somewhat fragmentary. The subjects were oil shales of Canada, Estonia, Israel, Norway, Spain, and Turkey. S. Bharati (Norway) described a new specific Upper Cambrian local oil shale yielding on pyrolysis little oil that is enriched in aromatic hydrocarbons; a high uranium concentration is typical of this shale. On the whole the shale described is very similar to Dictyonema shale of Estonia, a close analogue of which is also found in Sweden. Results of an investigation on Upper Ordovician *Gloecapsamorpha prisca* alginite from Canada were presented by L. D. Stasiuk.

A thorough report on principles and technique of the oil shales petrographic analysis was presented by A. Hutton (Australia). In his opinion, classification of kerogens into Types I, II and III is arbitrary as Type II, for example, is usually a mixture of Types I and III.

In papers of the geochemical nature presented at the meeting stress was laid on biomarkers. It seems that sulfur-containing "chemical fossils" as well as the individual isotopic composition of biomarkers are topical at present (T. I. Eglinton et al.). Study of biomarkers in sedimentary rocks led O. K. Bazhenova (Russia) to the conclusion that some of these structures were formed independently from the formation of kerogen matrix.

Papers on analytical methods for oil shales and shale oil were quite numerous. Possibilities of solid state ^{13}C NMR (G. D. Love, F. P. Miknis, C. E. Snape et al.), mass-spectrometric analysis (C. .M. White et al.), chromatographic separation techniques (K. D. Bartle, C. M. White) and some other methods were discussed in detail. Determination of organic sulfur forms by various methods (high pressure temperature programmed reduction, X-ray and NMR techniques, gas chromatography and mass-spectrometry, selective chemical modification) seems to be actual today.

As to the oil shale processing, its economics has been evaluated by E. Ekinci (Turkey); in his opinion the economic grade oil shale for combustion must have a minimum upper calorific value of 750 kcal/kg on dry basis, for processing into oil a minimum yield of the latter is considered to be about 25 l/ton. Some promising technologies for oil shale processing have been discussed. Thus, S. D. Carter, U. M. Graham et al. (USA) analyzed in their paper advantages of fluidized bed retorting of oil shale and characterized the multi-stage process KENTORT II that has been developed at the Center for Applied Energy Research, University of Kentucky. Processes employing hydropyrolysis were evaluated by M. J. Roberts et al.; at the Institute of Gas Technology (Chicago) a pressurized fluidized-bed hydroretorting process has been developed and scaled-up from a 100 g batch unit to a 100 kg/hr semi-continuous one. It seems also that hydrous pyrolysis of oil shales is a way to influence considerably the yield and composition of shale oils (A. K. Burnham - USA, E. Ekinci and Y. Yürüm — Turkey). Interesting possibilities to use solar energy for the gasification of oil shales were demonstrated by M. Paolucci (Italy). The shale oil heavy residues can be successfully used as a raw material for manufacturing carbon materials (F. Derbyshire).

And yet, the only processes described at the meeting for utilizing oil shales on an industrial scale were those applied in the Estonian oil shale industry. Let us hope that more of them will be presented at the next ASI on oil shales.