GEOL. CROAT.	49/2	333 - 334				ZAGREB 1996

Abstract - Note

Justifiability of the Biostratigraphy Explorations in Petroleum Geology

Krešimir **KRIZMANIĆ** and Vlasta **PREMEC FUČEK**

PROCEEDINGS

1. INTRODUCTION

In consequence of the ever demanding tasks which have been addressed to the oil industry concerning both efficiency of the exploration process and the emphasised economy, the trend of neglecting fundamental geological disciplines, in which biostratigraphy belongs, has become obvious.

Petroleum geology discriminates against "classic" geological explorations in favour of seismic and well-log methods because of the swiftness, mathematical exactness and economic saving. However, together with the undisputed qualities of geophysical techniques, it is very often forgotten that such data, which are to be used in the correlation and modelling of a given geological object (depression, field), must be calibrated with the data gained by petrographical, sedimentological, and also, biostratigraphical analyses and interpretations (LUČIĆ & KRIZMANIĆ, 1993).

Therefore, such a short-term economic benefit, that has been achieved by not using biostratigraphy in the exploration process, is often later negated.

2. METHODS AND GOALS OF BIOSTRATIGRAPHY RESEARCH

Biostratigraphy as a science bloomed with the development of the oil industry. Through deep drilling explorations, palaeontologists obtain multitudinous data on microfossil assemblages in the rock samples (cuttings or cores). Although such exploration in drill-holes is accompanied by many problems, there are also some advantages.

Biostratigraphy is based on the recognition of species, definition of their geological ranges, and therefore determination of age. After establishing the stratigraphical borders and resolving the stratigraphy in a few wells, the lateral extent of the subsurface layers becomes known through well-to-well correlation. However, biostratigraphical data are more valid when utilised in conjunction with other related sciences (biology, ecology, radiometry, eustacy, magnetometry, etc.), to reconstruct a mosaic of geological events.

Only three palaeontological disciplines utilised the most in the biostratigraphical research of the INA-Naftaplin Oil Industry are mentioned here.

2.1. MACROPALAEONTOLOGY

Dispite the often very rare macrofossil occurence in borehole materials particular mollusc genera and species which were considered to be outstandingly useful in the correlation of sediments and oil and gas saturated beds in Paratethys can be traced. Some well-known index fossils (e.g. *Radix croatica*, *Congeria banatica*, *Paradacna abichi*, *Congeria rhomboidea*) were generally accepted as age indicators for many years, with little additional consideration of their validity.

2.2. MICROPALAEONTOLOGY

Microfossil assemblages of foraminifera, ostracoda and silicoplacentina were analyzed from borehole rock samples. The appearance of species, stratigraphic range, abundance, as well as the composition of whole biocoenoses have been closely examined. Besides conventional palaeontological literature, contributions from INA-Naftaplin's biostratigraphers are also utilised as in a successive series of sediments phylogenetic lineages are easily noted. A good example of these are the clastic Middle to Upper Eocene sediments in the northern Adriatic, which contain fossils representing the complete evolutionary lineage of the *Turborotalia cerroazulensis* group, as well as the species succession of the genus *Globigerinatheka* (PREMEC FUČEK, 1995; PREMEC FUČEK et al., in press). Consequently, the lack of other index fossils in our latitude, proved this lineage to be advantageous in resolving biostratigraphic problems.

2.3. PALYNOLOGY

Due to the costs of maceration, slide preparation and analysis, palynology is used mainly for sediments where there are no other palaeontological data, e.g. sometimes the sediments are micropalaeontologicaly sterile, but palynologicaly very rich. This is commonly

INA-Naftaplin, Laboratory Dept., Lovinčićeva 1, HR-10000 Zagreb, Croatia.

the case with Upper Tertiary sediments which are most often the most interesting for petroleum geology. In these homogenous sandstones it becomes feasible to determine stratigraphical and palaeoecological characteristics by using palynological biozonation (SÜTÖ-SZENTAI, 1988).

Palaeontologists obtain information on palaeoenvironment through collecting data about the habitat (marine, brackish, freshwater...), mode of life (planktonic, benthic...), climatic conditions (tropic, moderate...), etc. Morphology of the taxa, chemism, preservation and many other parameters are also extremely important. All observations are compared with relevant literature and if some new information is obtained it is published.

Biostratigraphical and palaeoecological data are enhanced with petrographical and sedimentological rock characteristics, chemical analyses etc., so that all the information on age, type of rock and depositional environment becomes known. Sometimes the structural and tectonical framework may also be defined. Such a multidisciplinary approach based on the results of the scientific investigation of many specialists, is highly reliable and can be checked and compared with other scientific investigations.

3. BIOSTRATIGRAPHICAL APPLICATION IN THE OIL INDUSTRY

In the context of industrial applicability, biostratigraphy plays a unique role in resolving the multiplicity of geological problems which arise during the exploration and exploitation activities of petroleum companies. By using chronostratigraphical and palaeoecological data, accurate and detailed well-to-well correlation is made in order to facilitate the interpretation and prediction of reservoirs. Biostratigraphy is established as one of the main techniques used for this purpose because easily distinguishable changes in the fossil record commonly occur within sequences which appear uniform on lithologic and electric logs. Structural traps for oil and gas can sometimes be simply recognised using geophysical techniques. However, a larger problem is involved in the regional mapping of palaeogeographic and environmental parameters which influence the stratigraphic controls of hydrocarbon distribution. The accuracy of these maps depends on the precision with which isochronous surfaces can be identified (STAINFORTH et al., 1975). Exclusive use of seismic, well log or lithostratigraphic data is a mistake, because rocks of physically similar composition at many points, commonly prove to be different in age.

Furthermore, in a sense of a new economy, the exchange of knowledge and information through conversation becomes more and more important in business. As each individual contributes personal ideas and experience in group discussion amongst specialists with multifarious knowledge and a common aim, such ideas become refined by the group. They make a team, without the coercion or initiative of superiors. The result of such teamwork is, because of enthusiasm, healthy competition, rivalry and a desire for new understanding, very often remarkable by its originality, lucidity, applicability and rapidity. Direct saving and profit is shown, along with better efficiency, in improving horizontal and vertical communication as well as stimulating dynamism within the firm. The competitiveness of the company is also improved because only such agile, prompt, and dynamic systems are competitive.

4. INSTEAD CONCLUSION

I beg of VIP card possessors in oil companies not to neglect the fundamental disciplines such as biostratigraphy and sedimentology, cause without them there is no prosperous geology.

Dr. Jean DERCOURT, President of the Commission for the Geological Map of the World, excerpt of the oral presentation on 8th MAEGS, Budapest, 1993.

5. REFERENCES

LUČIĆ, D. & KRIZMANIĆ, K. (1993): Laboratorijske tehnike i metodika primjene rezultata tijekom geološkog istraživanja i razrade podzemlja.- Naftaplin, 1, 15-19, Zagreb.

PREMEC FUČEK, V. (1995): Biostratigraphy and Planktonic Foraminiferal Lineages of the Middle to Late Eocene Succession in the North Adriatic Sea.- First Croat. Geol. Congr., Opatija 18-21.10.1995., Abstracts, 77, Zagreb.

PREMEC FUČEK, V., BABIĆ, Lj., BAJRAKTAREVIĆ, Z. & GUŠIĆ, I. (in press): Planktonic Foraminiferal Biostratigraphy and Paleoecology of the Middle to Upper Eocene Succession in the North Adriatic Sea.- IGCP-286, Early Paleogene Bentos, Ljubljana.

STAINFORTH, R.M., LAMB, J.L., LUTERBACHER, H., BEARD, J.H. & JEFORDS, R.M. (1975): Cenozoic planktonic foraminiferal zonation and characteristic of index forms.- Paleontological Contributions, 62, The University of Kansas, Lawrence, 425p.

SÜTÖ-SZENTAI, M. (1988): Microplankton Zones of Organic Skeleton in the Pannonian s.l. Stratum Complex and in the Upper Part of the Sarmatian Strata.- Acta Bot. Hungarica, 34/3-4, 339-356, Budapest.