GEOBIOLOGY



The Geobiology Team is part of the TNO. It is the main biostratigraphical agency in the Netherlands. The members of the team are strongly proficient in palynology and micropaleontology, and constitute one of the leading expert groups in applied paleoenvironmental research. The team is embedded in an or-

ganization developing new geological, geophysical and geochemical tools for the E&P market. This allows TNO to provide tailored solutions for complex problems by combining up-to-date academic research and professional expertise.

OUR SERVICES INCLUDE:

- Age determination, biozonation and well correlation.
- Paleo-environmental reconstruction.Integrated field studies and basin
- reconstruction.
- Custom built geobiological databases.Correlation based on stable isotope
- and statistical analyses. - Hot shot analysis.

BIOGENIC SILICA-BASED STRATIGRAPHY

The innovative power of TNO is exemplified by the recent development of a new stratigraphic tool based on biogenic silica microfossils (BIOSIL). BIOSIL was originally developed for late Paleozoic continental deposits barren of any other fossils. We are now exploring the application potential since biogenic silica is widespread in various depositional environments throughout geological time. The biogenic silica is derived from the cells of higher land plants (flowering plants, gymnosperms and ferns). Dissolved silica is stored as so-called phytoliths (plant stones) in roots, stems and leaves. After decomposition of the organic material these phytoliths can be preserved in the fossil record. The applicability of a biogenic silica-based stratigraphic tool has been successfully tested in three case studies in The Netherlands, Saudi Arabia and Colombia. The developed tool has great potential for enabling cross-correlation between late Paleozoic continental deposits, which so far was a significant problem, and it has been recently extended to mid-Cenozoic deposits of Colombia.

1

MICROPALEONTOLOGY

FORAMINIFERA, OSTRACODS, PYRITIZED DIATOMS AND RA-DIOLARIA.

The importance of foraminifera for (paleo-)environmental studies is well-known in academy as well as in industry. Together with their high preservation potential, the wide range of environments in which foraminifera occur make them ideal tools for biostratigraphical and paleoenvironmental studies in marine deposits. With increased need for detailed stratigraphy, the classical biostratigraphy does not provide sufficient information. Therefore, paleoenvironmental interpretation is increasingly important. Quantitative micropaleontological analyses provide information on the paleoenvironmental changes, such as paleobathymetric variation and also qualitative paleoproductivity. For example, the integration of depth marker species and the ratio between the number of planktic and the benthic foraminifera provide paloebathymetric reconstructions.





Schematic reconstruction sea-surface paleoproductivity and paleodepth during the middle Paleocene in Tunisia (Guasti et al. 2006) based on variation in the foraminiferal assemblages.



Schematic paleodepth setting of the Paleocene shelf in the Southern Tethys based on specific foraminifera marker species. Certain species of planktic and benthic foraminifera live preferably within a restricted water-depth interval. Assemblage changes of these species provide useful information for paleoenvironmental conditions and trends.



PALYNOLOGY AND SEG MODEL

The experienced palynology team has been successful in consulting projects worldwide. Detailed age and paleoenvironmental interpretation can be given for Paleozoic to recent geological periods through palynomorph analysis (pollen and

spores, dinoflagellate cysts and acritarchs). High-resolution quantitative palynostratigraphy is performed to respond to the increasing need for a paleoenvironmental approach in well correlation and reservoir characterization.

The SEG Model is one of the powerful tools improving the understating of hydrocarbon reservoirs. This so-called Sporomorph EcoGroup model (SEG) is a new approach in palynostratigraphy first developed for Jurassic deposits in the North Sea basin. With this methodology sporomorphs are linked to the actual vegetation elements, leading to a detailed paleoecological interpretation of the quantitative palynological signal. The resulting paleoenvironment and paleoclimate record is used to enhance the stratigraphical correlation of wells and to develop "facies" maps based on the spatial distribution of the SEG groups through time.

The SEG model approach is currently applied in reservoir characterization and well correlation studies in late Carboniferous and Jurassic terrestrial deposits from north-western Europe.





PALSYS DATABASE

PalSys is a up to date system for archiving and cataloguing fossil species. This includes their taxonomical, stratigraphical, geographical, paleoecological characteristics. Palsys is flexible in honoring specific needs of individual oil companies. Currently TNO seeks industrial partners for further development of the Palsys Database including new features such as a range-chart generator.







CASE STUDY

Detailed stratigraphic framework of North Sea wells A15-3 and A15-4 and correlation to Marine Isotope Stages 103 to 94 based on multi proxy microfossil data. The glacial cycles in this period, characterized by the influx of typical cold-water dinoflagellates (e.g. Filisphaera), cause alternate clay-silt sediment cycles in which shallow gas has accumulated.



Combining palynological and geochemical parameters to unravel climatic history during the Quaternary in the AB block potential for O&G exploration Palynological and geochemical analyses of a number of wells are part of an ongoing project to characterize the Piacenzian/ Zanclean boundary interval (i.e the early Quaternary glaciations following the latest GTS recommendations). Here, ultra-high stratigraphy is coupled to climate cycles (characterized by pollen and geochemical data), which drive regional sedimentary facies and sealing properties. Sediments are derived from two principal sources, based on mineralogical data: longdistance transport and deposition of finer material from the Scandinavian shield in the Northeast during cold periods (Baltic river system) and courser-grained (silty to fine sand) smectite-rich sediments from proximal volcanic continental areas to the south (Rhine Meuse river system). The latter were delivered during warm periods due to enhanced river-runoff. The project has a relevant economic impact in the exploration for shallow gas, and few wells in this area are already producing.

TNO.NL

CONTACT

Elisa Guasti T 088 866 4749 E elisa.guasti@tno.nl

TNO.NL