

Report IAS Postgraduate Grant Scheme, 2nd session 2004

Liesbeth Breesch
K.U.Leuven Fysico-Chemische Geologie
Celestijnenlaan 200C, B-3001 Heverlee, Belgium

Reconstruction of the diagenesis and fluid flow in the Northern Oman Mountains, United Arab Emirates : implications for oil and gas exploration

The search for new sources of fossil fuels is nowadays often situated in structural more complex areas, such as "Foreland Fold and Thrust Belts" (FFTB's). These belts form by foreland basin deformation and subsequent overthrusting of thrust sheets. Thick successions of sediments accumulate in these foreland basins. Potential source rocks are formed and maturation occurs thanks to burial and increasing deformation, resulting in the expulsion and storage of petroleum and gas in porous reservoir rocks. Afterwards the problem rises to locate these hydrocarbon accumulations in the deformed foreland. In addition, aqueous fluids are expelled during the positioning of the thrust sheets. These fluids can have a positive or a negative effect on the reservoir rocks by several diagenetic processes such as dissolution, cementation, dolomitisation, fracturation, etc. Existing reservoirs can be destroyed or ameliorated, i.e. new reservoirs can be created. That is why the reconstruction of the fluid movements and their processes in relation to the deformation history is primordial.

The subject of this research is the Foreland Fold and Thrust Belt of the Northern Oman Mountains, in the UAE. The Oman Mountains were formed during 2 phases of compression in the Upper Cretaceous and the Oligo/Miocene. Due to eastward subduction of the Neotethys, obduction of tectonic nappes onto the Arabian passive margin took place in Late Cretaceous times. The Semail ophiolite, Hawasina basin sediments and Sumeini slope deposits were emplaced in a piggyback manner onto the Musandam carbonate platform. The recent topography of the Oman Mountains only originated during a second compression phase in the Tertiary. This resulted in large-scale folds and steep reverse faults and a displacement of the Musandam platform 15 km to the west along the Hagab thrust.

The objective of this PhD is to reconstruct the fluid flow and diagenesis through time in the Musandam carbonate platform, placed in the framework of the tectonic evolution of the orogeny. The fluids involved will be characterised by petrographical and geochemical analyses. Integrating all these data about pressure (P), volume (V), temperature (T), and composition (X) of the fluids, modelling of the PVTX-t conditions of the fluid flow through time (t) will be attempted.

Finally the ultimate aim of this and other studies of foreland fold-and-thrust belts all over the world, is to deduce which processes can be generalised and which are restricted to the location.

Thus predictions of the hydrocarbon potential can be made and exploration scenarios can be proposed.

The financial support provided by the IAS postgraduate grant scheme was used for fieldwork and in more detail for the flight ticket, car rental and shipping costs of the collected samples. After the 24th IAS Meeting of Sedimentology in Oman, 10-13 January 2005 I traveled to Ras Al Khaimah in the United Arab Emirates. Samples were taken in outcrops which are both geographically and stratigraphically spread throughout the Musandam platform. This is necessary to make a representative model of the fluid flow. Two types of outcrops were chosen based on the presence of crosscutting calcite-filled fractures or dolomites. In both cases study of these samples can provide information about the fluid type, diagenetic processes and timing of the fluid flow. The calcite and dolomite samples will be analysed using petrographic (polarised and cathodoluminescence microscopy) and geochemical analyses (stable and Sr isotopes, trace elements, fluid inclusion microthermometry) to make data available for the modelling part, which will take place later on during the PhD.

I would like to thank the IAS for their financial support of this study.

Expenses

Flight ticket Brussels-Muscat, Dubai- Brussels	541.51 euro
Car rental (rate 1 euro=4.55 dirham)	1750 Dirham = 384.62 euro
Shipping costs samples	45.00 euro

TOTAL : 971.13 euro

The allocated grant amounts to 970 euro.