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Reservoir- and aquifer-characterisation using outcrop analogs

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Characterisation and prediction of the subsurface architecture in hydrocarbon reservoirs and groundwater aquifers requires a genetic understanding of sedimentary heterogeneities. This can be achieved in studying comparable surface outcrop analogs. We propose a simple, process-based methodology to analyse heterogeneities in a rigorously hierarchical way, moving from the smallest to the largest sedimentary units (particles to basins):

1) Microscale heterogeneities: caused by particle and pore properties (size, composition, texture etc.), which are determined by depositional and diagenetic fluid dynamics.
2) Mesoscale heterogeneities: caused by various stratification styles, which are controlled by the major hydrodynamic processes.
3) Macroscale heterogeneities: caused by facies and architectural elements, recording dynamics and preservation of facies tracts.
4) Megascale heterogeneities: caused by the fundamental sedimentary cycles and sequences, which reflect the stratigraphic dynamics of small baselevel fluctuations.
5) Gigascale heterogeneities: caused by the stacking of fundamental cycles within a cycle hierarchy, which is controlled by long-term baselevel dynamics.

Understanding the formative processes of each scale allows to deduce „rules" and predictions on the distribution of heterogeneities in the subsurface. This approach of „dynamic stratigraphy" is illustrated by two case studies using outcrop analogues for subsurface reservoirs and aquifers. A combination with petrophysical (porosity, permeability, gamma-ray logs) and geophysical tools (3-D georadar) should lead to an integrated data set for reservoir/aquifer modelling from microscopic to seismic scale.

Engineering Properties of Qauternary Deposits in Basrah City, South of Iraq

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As due to the strategic importance of Basrah city, south Iraq, the architectural expansion of the city requires a great deal of studies of the geotechnical properties, engineering behaviors and classification of the soil bearing strata reprisented by the Quaternary deposits. For such purposes a number of (121) sites distributed randomly all around the city through (478) boreholes of depths (10-48) m below mean sea level are studied.

The data are obtained from the tests of Atterberg's limits, grain size distribution, and the (n-values) for SPT.

The Quaternary deposits are classified into two main groups; firstly the cohesive represented by the recent clay and silty clay and Alhammar Formation deposits. And secondly is the noncohesive deposits represented by sands of Dibdiba Formation.

According to the consistency of cohesive deposits and the compactness of noncohesive deposits, ten strata can be identified starting from the ground surface, as follows:

Stiff brown silty clay (CL & CH), very stiff brownish-grey silty clay.or clayey silt (Cl, CH & OH), stiff grey clayey silt (CL), medium to stiff gray clayey silt laminated with silt (CL), soft grey clayey silt laminated with silt (CL, CH & OH), medium to stiff grey clayey silt (CL, CH & OH), medium to siff grey clayey silt (CL, CH & OH), stiff grey clayey silt (CL), very stiff grey sandy silt clay and clayey silt (CL, CH & OH), hard brown clayey silt (CL & CH), and very dense silty sand with sand (SM).

(Geo)Statistics on thin turbidite sandstones in the Upper Austrian Molasse Basin

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The Tertiary Molasse basin in Upper Austria is part of the Alpine foredeep. The Oligocene/Miocene Upper and Lower Puchkirchen Formations and the basal Hall Formation were deposited in this foredeep in a deep marine environment and consist of an alternation of siliclastic deposits with various grainsizes. The thin bedded turbiditic sandstones form gas reservoirs in RAG's concession area. Detailed geological characterization of the reservoirs is difficult. The individual sandstones and sandy conglomerates are generally too thin to be resolved on a seismic section. Reservoirs are made up of several sandstone sheets with interbedded shales and conglomerates. The succession is characterized by numerous submarine erosions. Prominent impedance boundaries are formed by a range of lithological contacts and are not always related to a reservoir rock. In the past, only mapable packages that contained reservoir sandstones were interpreted on the seismic.

In the statistical approach, well reservoir parameters and seismic attributes are compared to find relations between them. One or more surfaces are mapped that are associated with a sequence of interest. Various seismic attribute maps of this surface are generated. If a correlation is found it can be used to create a reservoir property map by co-kriging the seismic grid and the petrophysical data. Statistical techniques are used to identify separate populations or groups. The standard tests of statistical significance are not applicable where the data points are not independent. It has proved difficult to model the subtle stratigraphic variations. Map validation is being used to date: Evaluation of patterns and distributions in light of other geological or production information.