

Glacial Play Types in the Pedirka Basin, Australia

Middleton, Mike F.¹, John Heugh² (1) Murdoch University, N/A, Australia (2) Central Petroleum, N/A,

The Pedirka Basin is an under-explored Permian-aged basin, located in central Australia. The Permian succession is covered by a thickness of over a kilometer of Mesozoic sediments of the Eromanga Basin. It is understood that the Amadeus Basin, which is immediately to the west of the Pedirka Basin, underwent up to 2 km of uplift during the Carboniferous, and probably sourced sedimentation into the Pedirka Basin. Further, it is proposed from a number of lines of evidence, including paleomagnetism, that an ice sheet covered much of central Australia, during the Early Permian. These considerations are the basis of our premise for the existence of glacial sedimentary features that may form petroleum traps in the basal Permian sequence of the Pedirka Basin.

Features with strong characteristics of complex braided stream systems, glacial moraines, and drumlin system are proposed, based on the seismic interpretation of data from the western part of the Pedirka Basin.

Giving consideration to the known sedimentary deposits, within the western part of the Pedirka Basin, it is not unreasonable to propose a glacial moraine or mound play-type. Such features are clearly mappable on the seismic data. This play-type model for the basal Permian sequence entails linear mounds (up to 10 m in height and several kilometers long) of mixed and largely unsorted sediments, which have been gradually buried (encased) in a dominantly lacustrine and swamp environment. The lacustrine environment can provide source, and the shale encased mounds can provide the reservoir. Such a play will be drilled in 2006.

Low-Latitude Ordovician Glacial Sediments of Gondwana: Reservoir Quality Prediction across the Saharan Platform

Pyke, Gregg¹, Jonathan Redfern² (1) Heriot Watt University, Edinburgh, United Kingdom (2) University of Manchester, Manchester, United Kingdom

The sediments of the Mamuniyat Formation (Ashgillian, Upper Ordovician) of Libya, Algeria and Tunisia were deposited within a glacially-influenced, typically shallow-marine setting on the continental shelf, beyond or at the margins of a large continental ice-sheet. On a basin-scale, broad packages of discrete sedimentary facies are apparent, with visible trends in both sand quality and distribution. However, as is typical of many ice-proximal – distal settings, detailed analysis at outcrop reveals rapid 'high-order' lateral facies changes and at least 2 internal unconformities causing uncertainty in reservoir quality prediction.

Detailed analysis of the Mamuniyat Formation from both outcrops and the subsurface of Western Libya, Eastern Algeria and Southern Tunisia has revealed that whilst the main control upon the distribution of reservoir quality is the primary sedimentary fabric, there is a complex diagenetic overprint that hinders conventional reservoir quality prediction, both regionally and locally.

The primary diagenetic control on reservoir quality is the development of quartz overgrowths associated with increased overburden pressures and temperatures encountered during burial. Quartz overgrowths progressively restrict the dimensions of the pore network, reducing both the porosity and permeability of the reservoir. On both a regional and a local scale reservoir quality is further modified by localised fracturing and the development of a late-stage pore-filling kaolinite cement that occurs as a result of meteoric water-flushing.

The extent and duration of burial through time has been modelled, paying particular consideration to the effects the Caledonian, Hercynian and Alpine Orogenies have on quartz overgrowth development and subsequently reservoir destruction.

Reservoir Enhancement Processes for Carbonates of Northern Gondwana

Lapointe, Philippe A.¹, Andrew Barnett¹, Jacqueline Camy-Peyret¹, Georges Nely¹ (1) TOTAL E&P, 64018 Pau, France

The Alpha field, in the Timan Pechora Basin (Komi Republic, CIS), is a multihorizon oil-bearing reservoir. The Upper Devonian carbonates of Reservoir A and Permian carbonates of Reservoir B suffered a series of long term subaerial exposure that resulted in reservoir characteristic improvements.

The Interpretation of the 3-D seismic data using the in-house developed Sismage software suggested that karst occurred in the Frasnian / Fammenian section in close relationship with the structural features and that karst generated epikarst and collapse created breccia with impact on the Permian carbonates deposition.

Detailed examination of the Devonian cores supports the karstic nature of the reservoir showing conduits, caves network, fissures enlarged by leaching, karstic breccia, and speleothems. The following karst scenario is proposed: 1) several sub-aerial emersion events occurred during Upper Devonian times triggering coastal karst or epikarst, partly controlled by structural geology (fracture and fault patterns) and partly controlled by sedimentary facies distribution; 2) later hydrothermal endokarstic dissolution occurred prior to oil migration and was controlled by a later, post-compaction tectonic event and the pre-existing heterogeneities.

The Permian carbonates deposition was structurally controlled by high and lows somewhat related to large scale hydrothermal collapse and faulting controlling lower Permian anhydrite dissolution. The carbonate platform suffered probably long term sub aerial exposure which evidences are found in several wells that resulted in calcrete palaeosol development at the top of the Microcodium invaded zone, indicated by rhizcretions.

Sandstones Petrography of the Devonian Zakeen Formation, Southern Iran

Naaeeji, Mohammad Reza¹ (1) Department of Geological & Geochemical Studies and Research, Exploration Directorate of National Iranian Oil Company (N.I.O.C.), Tehran, Iran

A sequence of the Devonian clastic sediments (Zakeen Formation) at 103 km north of Bandar- Abbas, south of Iran was studied. This study has been done to determine the clastic size, petrofacies and roundness variations

through the lithological column of Zakeen Formation. The Devonian sediment in Iran is a new prospect for gas exploration. The Zakeen Formation can be correlated to the Devonian gas-bearing formations (Tawil, Jauf and Jubah) of Saudi Arabia. Clean sandstone have been frequently found in lower half of this Formation but in upper half winnowing of sandstone decreased and sedimentary structures of shallow marine environments such as flaser bedding and cross-stratification are less frequent. The Zakeen sandstones are much cleaner than that of sandstones of Tawil, Jauf and Jubah formations. Six petrofacies such as Arkosicarenite, Subarkose, Quartz arenite, Siltstone, Dolomite and Shale have been recognized. Investigation on sandstone samples indicated that arkosicarenite is outstanding in upper half, caused increases of feldspar toward top. Measured roundness of the most sandstones of the Zakeen Formation is in subangular realm and the least frequent type is sub-rounded. Measurement of clastic size through the lithological column of this Formation indicates a fining upward trend which corresponds to the fact that muddy continental shelf facies frequently has been found in upper part. The greatest size of quartz and feldspar belongs to sub-tidal sand wave facies. Some quartz grains of this Formation inherited an eroded quartz overgrowth rim which indicates a recycled origin for sandstone.

Distribution and Hydrocarbon Prospectivity of Gondwana Basin in India

Mathuria, TARUN KUMAR¹ (1) ONGC, NAZIRA ASSAM, nazira, India

ABSTRACT: Hydrocarbon occurrence and commercial production from worldwide Gondwana basins have emboldened its exploration in geologically analogous sedimentary basin of India in order to probe their hydrocarbon prospectivity. Preliminary exploration efforts carried out in these basins viz. South Rewa, Satpura and Jharia basins have yielded valuable exploration leads for pursuing the yet to find hydrocarbon resources. The Gondwana distribution in India falls in three categories. 1) the E-W Narmada, Satpura, South Rewa and Damodar valley, the NW-SE trending Son—Mahanadi and Pranita Godavari basin. 2) Extra- Peninsular area of Pura—Malda and partly Upper Assam. 3) East Coast basins of Cauvery, Palar, Krishna Godavari and Bengal basin. Triggered by discoveries in North sea, China, and Australia, the Gondwana basin received continued attention for hydrocarbon exploration. Huge Natural gas occurrences are envisaged in Gondwana basin. In this context detailed evaluation of major coal bearing strata of these basins have attained priority and emerged as potential source rock for hydrocarbon generation and act as a prime exploration target in view of their closed proximity with global basins. Occurrence of oil and gas in analogous basins in the world has further strengthened the possibility of existence of rich petroleum systems in similar stratigraphic arena within the Indian Gondwana basins. In addition, the contributions of coal as major source for coal bed methane exploration / exploitation is also an aided feather in cap to widen the scope of exploration.

Reservoir Quality in Glacial Sediments: Field Examples From The Petroliferous Permo-Carboniferous Gondwanan Strata of the Cooper Basin, Central Australia

Cubitt, Chris¹ (1) Woodside Energy Ltd, Perth, Australia

The proximity of Gondwanan ice sheets, which covered the southern portion of the Australian continent in the Permo-Carboniferous, led directly to the deposition of the Merrimelia Formation and Tirrawarra Sandstone in the Cooper Basin, Australia's largest onshore hydrocarbon bearing basin. Initially, the Gondwanan glaciers were dominant such that only terminoglacial facies were deposited (Merrimelia Formation). Subsequently, the glaciers retreated until only braid plain or proglacial sedimentation dominated (Tirrawarra Sandstone).

In general, proglacial facies form rocks with potential reservoir quality. In contrast, terminoglacial environments typically form "seal" rocks. Reservoir quality of the Merrimelia and Tirrawarra units has been determined by studying the types and amounts of rock fragments present, facies style, diagenetic/thermal overprint, and compactional effects.

A distinctive feature of rocks formed in glacial settings is the inhibition of clay laden meltwaters into the sedimentary pile. In the case of the glacio-aeolian sandstones (Merrimelia Formation), of the Merrimelia field detrital smectite/illite derived from infiltrating glacial meltwaters coated framework grains. This detrital clay "coat" was subsequently transformed to illite at depth, compartmentalising this highly porous rock and drastically reducing the natural deliverability of these sandstones. In contrast, the longitudinal bar sandstones (Merrimelia and Tirrawarra "facies") at Malgoona field are highly illitic where "boxwork" illite morphologies form isolated "psuedomatrix" after the breakdown of feldspars and volcano-clastic rock fragments. This mode of illite occurrence has little effect on reservoir deliverability as the clay does not inhibit pore throats. Subsequently, oil has been produced from these reservoirs, albeit at a slow rate, since the mid-1980's.