**The origin of Upper Sinian travertine in the northwestern Tarim basin, NW China: Petrological, geochemical and shrimp-U-Pb zircon geochronological constraints**

Qian, Y.X.[1], Yang, S.[2], Chen, D.Z.[3], You, D.[1], Chen, Y.[1], Liu, Z.[2], Wu, S.[2]

[1] Wuxi Research Institute of Petroleum and Experiment Geology, SINOPEC, Wuxi, Jiangsu 214126, China – Qyx9167@vip.sina.com
[2] Exploration & Development Research Institute, SINOPEC, Beijing 100083, China
[3] Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China

Travertine and tufa are important proxies in the palaeo-climatic, palaeo-hydrological, palaeo-botanic and palaeo-environmental reconstructions and provide important clues in the neo-tectonic movement identification and assessment for environmental pollution. In this study, we describe the occurrence, geochemistry and U-Pb Zircon geochronology of travertine hosted in detrital rocks of the Upper Sinian Sugaitbulak Formation. travertine occurs as purple and brown terrigeous-clast-bearing vein-like and stratoid micritic limestone and medium dolomite; impregnated by hematite with thickness from 1 to 6 m,characterized by variously typical structures including: (a) rhyolitic-like flow, tubular and breccia structures; and (b) the matrix was cemented by various minerals in the order of fibrous dolomite, medium-coarse mosaic dolomite, calcite, quartz, and barite or minor gypsum.

Compared with the overlying algal dolomite of Qigebulak Formation ($Z_2q$), the travertine are enriched in terrigenous minerals such as quartz and clay. In addition, the presence of hematite indicates that it had been precipitated in relatively oxidizing environment. While enriched in Cr, V, Co, Ti, Cu, Zn, Hg and P while depleted in Sr (< 10 ppm). Take the low $\delta^{18}O_{PDB}$ (average at -8.6 ‰) and Z (<120) into account, it supposed be formed in a meteoric water environment. The $^{87}Sr/^{86}Sr$ ratios of the travertine (average at 0.710116, n=12) are relatively higher than those of the overlying $Z_2q$ algal dolomite (average at 0.709351, n=3). The Correlation of $^{87}Sr/^{86}Sr$ ratio with$\delta^{18}O_{PDB}$, $\delta^{13}C_{PDB}$ and the content of $SiO_2$ and $Al_2O_3$ indicate that the high $^{87}Sr/^{86}Sr$ ratio might be interpreted to a combination of results of clay mineral introduction, quartz dilution, and specific fluid-rock reaction. $\delta^{34}S_{V\text{-}CDT}$ of barite and gypsum range from 7.9 ‰ to 8.4 ‰, equivalent to or slightly higher than that of hydrothermal origin, suggested to be precipitated in an open system rich in $SO_4^{2-}$ and sulfate ion may be derived from formation water and/or a mixture of hydrothermal water and surface water. The average REE of travertines is 48.6 ppm. The PAAS-normalized REE pattern exhibits slightly positive Eu (average at 1.27) anomaly and weakly negative Ce anomaly (average at 0.93); both δEu and δCe are high that those of $Z_2q$ algal dolomite. Indicating it were formed from an oxidizing or weak-reducing environment. Microthermometric measurements of the homogenization temperature ($T_h$) of fluid inclusions of cements calcites yield $T_h$ = 57.5 ºC- 127.5 ºC. It may be inferred to be precipitated as travertine rather than tufa.

The detrital zircons of travertine were mainly of magmatic and re-sedimentary origin. For the magmatic zircons, Shrimp-U-Pb chronological analyses suggest that they were mainly of three groups: 1.938-2.029 Ga in Early-Proterozoic, 909.1 Ma in Neo-Proterozoic and 481.8-487.1 Ma in Early Ordovician. While the re-sedimentary zircons yield four groups of ages at 2.812-2.579 Ga, 1.9769 Ga, 803 Ma and 538.1 Ma. Since the most recent record of the zircons is 481.8-487.1 Ma, we believe that travertine were precipitated in the low-temperature hydrothermal fluids in The Middle Ordovician to late Ordovician, and might experience a series of geological process such as the meteoric water leaching and burial diagenesis.

Key words: travertine, fabrics and structures, mineralogy and petrology, geochemistry, detrital zircon U-Pb geochronology, Upper Sinian, NW Tarim basin

**Diagenesis of Paleogene 3rd member of Hetaoyuan Formation in Biyang sag, East China and its influence on reservoir bed quality**

Qiang, K.S.[1, 2], Wang, M.[3], Yang, D.Q.[2], Lin, S.Q.[2], Yan, Y.X.[2], Luo, J.Q.[2], Liu, G.L.[2]

[1] College of geosciences, China University of Petroleum, 102249 Beijing, China - qks80@163.com
[2] Research Institute of Petroleum Exploration and Development, Henan Oilfield, Sinopec, 450016 Zhengzhou, China
[3] Henan Oilfield Company, Sinopec, 473132 Nanyang, China

The Biyang sag is one of Meso- Cenozoic minor faulted lake basin enriched in hydrocarbon in East China, and Paleogene 3rd member of Hetaoyuan Formation is an important reservoir bed. This paper studies the diagenesis of clastic reservoir bed in Paleogene 3rd member of Hetaoyuan Formation and its influence on reservior bed quality, based on rock thin section, scanning electron microscopy, cathodoluminescence, X diffraction and physical properties data.

Paleogene 3rd member of Hetaoyuan formation was mainlt in the diagenesis A stage, with part in the diagenesis B stage. Diagenetic history was very different in different areas in the study area. The diagenesis in the southwestern Shuanghe area was more complex than the northeastern Houzhuang area. Diagenetic minerals include early particles wrapped chlorite, quartz and feldspar overgrowth and calcite cement crystal inlay in the Shuanghe area, and late diagenetic minerals are pore-filling barite, pyrite, kaolinite, montmorillonite and euhedral calcite. Due to scarce diagenetic authigenic minerals, only a small amount of quartz overgrowth, montmorillonite and kaolinite are found in the Houzhuang area.

Composition of sandstone, sorting, and particle size change greatly, and rock types include feldspar, quartz sandstone, feldspathic sandstone, lithic feldspathic sandstone and feldspathic lithic sandstones, and these sandstones have a high content of unstable minerals. Compaction and cementation decreased primary porosity of reservoir bed and permeability as well, resulting in poor eservoir bed quality. However, late-period dissolution of sandstone promoted the development of secondary porosity and improved reservoir bed quality. The sandstone in the study area can be divided into four types of diagenetic facies: diagenetic compaction consolidation, carbonate cementation, weak cementation, and unstable components dissolution. Unstable components dissolution facies has the best reservoir bed quality, followed by weak cementations. Rservoir bed quality is the worst for both carbonate cementation and diagenetic compaction consolidation. Generation of sandsone porosity varies significantly, and porosity values are different with the highest of 29%. Secondary porosity dominates in the Shuanghe area, and primary porosity dominates in the Houzhuang area. Hydrocarbon migration and accumulation is closely related to secondary porosity in sandstone reservoir bed.

Acknowledgements: The authors would like to thank SINOPEC for sponsoring the project and Henan oilfield for providing the sample material.

**Canyon-related wavy structures in the Shenhu Area, northern South China Sea**

Qiao, S.[1, 2, 3], Su, M.[1, 2], Kuang, Z.[4], Yang, R.[1, 2], Liang, J.[4], Wu, N.[1, 2]

[1] Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences, 510640-Guangzhou, China – qiaosh@ms.giec.ac.cn
[2] Guangzhou Center for Gas Hydrate Research, Chinese Academy of Sciences, 510640-Guangzhou, China
[3] University of Chinese Academy of Sciences, 100049-Beijing, China
[4] Guangzhou Marine Geological Survey, 510075-Guangzhou, China

Sediment waves have long been reported in a variety of marine setting in both tectonically active and inactive environments, including submarine levee-fan system and other basin or continental slope. The origins of sediment waves are ascribed to be generated beneath down-slope-flowing turbidity currents or tidal currents, along-slope flowing bottom current or gravitational processes. Sediment waves constructed by different processes vary in wave lengths, wave heights, wave dimensions change tendency along the slope and wave crest alignment related to the slope.

Wave fields have been identified in high-resolution multichannel seismic reflection data from the Shenhu Area, northern South China Sea (SCS). The Shenhu Area is characterized by retrogressive erosion of several N-S orientated, sub-parallel and regularly-spaced submarine canyons. These submarine canyons seemed to migrate in a northeastward direction under a strong bottom current from the middle Miocene to present. Therefore, the sediment waves in the Shenhu Area were previously suggested to be built by the combination of bottom currents and gravitational deformation.

Re-interpretation of high-resolution seismic data shows that the distribution of sediment waves in the Shenhu Area is limited to the head area of canyons and the crests between canyons. These sediment waves are classified into two types based on wave features and seismic reflection characteristics. Sediment waves in type are located on the head area of canyons in the north, and sediment waves in type are identified on the crests between canyons in the middle and lower reach of canyons. Although both of the two types of wavy structures exhibit some of the classical features of sediment waves, several specific characteristics exclude the inference that they would have a common origin. We argue that the wavy structures in field Ⅰ are produced by gravitational processes (gravity-driven down-slope creep), while the undulations in field are generated by depositional processes (overspilled or unconfined turbidity currents). Recognition of turbidity current sediment waves in the Shenhu Area doubts the strong bottom current effect from the middle Miocene and the subsequent migration of canyons.

Keywords: Sediment waves; Submarine canyons; Gravitational creep; Turbidity current; South China Sea

Acknowledgements: This study is supported by the National High Technology Research and Development Program (863 project) （2013AA0925010202）, and the National Natural Science Foundation of China (No. 41202080 and 41206047). We are grateful to GMGS for permission to publish this material.

**Dissolution characters and it's influerences to tight sand reservoir in Daniudi gas field, Ordos basin**

Qiu, L.[1], Xu, N.[1], Wang, J.[2], Zhang, X.[1], Yang, S.[1]

[1] School of Geosciences, China University of Petroleum of EastChina, Qingdao Shandong 266585, China – qiulwsd@163.com
[2] Geological Scientific Research Institute, SINOPEC Shengli Oilfield, Dongying, Shandong257015, China

The paper studied reservoir characters, diagenesis and forming method of high quality reservoir under microscopic study of polarizing microscope and SEM, to the Carboniferous-Permian tight sand o in Daniudi area in Ordos basin. And the result shows that tight sandstone in Daniudi gas field of Ordos Basin has a variety of pore types including intergranular dissolution pores, intragranular dissolution pores, matrix dissolution pores etc. These three types approximately account for 80% of total pore quantity and intergranular dissolution pores are the most while the proportion of primary pores and fractures are less. Quartz dissolution pores, which represent 70% of dissolution pore quantity, is the most important pore type in studied area, the second is kaolinite matrix dissolution pores. Microscopic evidences of quartz dissolution pores in tight sandstone reservoir in this region contain embayment edge of quartz grains, intergranular opening seams, excessive dissolution, quartz overgrowths, quartzose fragments and authigenic kaolinite dissolution etc. Quartz is dissolved directly which can be demonstrated by the slight dissolution phenomena of cement and carbonate debris in reservoir and the occurrence of honeycomb intragranular pores in quartzose fragments. Dissolution quantity of alkali-unstable minerals in the reservoir is usually between 1% and 23% which can contribute to the formation of high quality reservoir when it reaches more than 5%. In general, the contribution rate of quartz dissolution pores can arrive at 60%~90% or more. Quartz dissolution, which was usually formed after reservoir had suffered strong diagenetic transformation, mainly lies in intergranular pores beside grain margins, the pores decreased slightly in the late process of continuous compaction, and the corrosion degree determines the final development of reservoir property and formation of high quality reservoir.

Key words: tight sandstone, quartz dissolution pore, high quality reservoir, formation mechanism, Daniudi gas field

**Mapping Riverine Mud Deposits along the Inner Continental Shelf Adjacent to Doce River, Southeast Brazil**

Quaresma, V. da S.[1], Catabriga, G.[1], Godinho, E.[1], Bastos, A.C.[1]

[1] Dept Oceanography, Universidade Federal do Espírito Santo, Av Fernando Ferrari. 514 , CEP: 29075-910 – Vitória-ES, Brazil - valeria.quaresma@ufes.br

The eastern Brazilian coast is characterized by four major deltas: Paraíba do Sul, Doce, Jequitinhonha and São Francisco. These regressive deposits are distinct features along a starved coast, usually formed by soft cliffs. In addition to the development of extensive coastal beach ridge plains, these deltas are responsible for the formation of inner shelf mud deposits. Herein, the mud deposit associated with the Doce River delta is mapped using acoustic tools and sediment sampling. Sub-bottom profiler (3.5kHz Stratabox) and side scan sonar (Edgetech 4100 500kHz) were combined with 70 sediment samples to investigate the extent and thickness of the mud deposit. Results showed that the inner shelf is predominantly muddy, with higher mud contents and lower density occurring to the south of the river mouth. Silt fraction corresponds up to 70% of the mud content. Sub-bottom profiler (SBP) echo-character mapping also revealed the distribution of the mud deposit, showing the occurrence of fluid mud layers represented by a reflection-free pattern. Higher mud content and fluid mud layers were observed to the south of the river mouth indicating that riverine sediments tend to disperse to the south and accumulate first in this area. In terms of mud thickness, SBP data revealed that mud deposits can be up to 7m thick northwards from the river mouth. This may indicate that although fine sediments tend to disperse and accumulate towards the south, wave and/or current action can resuspend and transport fine sediments to the north. The transition to sandy beds is characterized by no penetration of SBP signal and usually occurs around 25 to 30 m water depth. The mud deposit is interpreted as a modern Holocene regressive deposit prograding over relict or palimpsest sands. The internal structure of the deposit is characterized by the occurrence of clinoforms, corroborating its progradational character.

Acknowledgments: This study was supported by CAPES (project 224/2010) and FAPES (project 54682860/2011).