Geophysical Research Abstracts, Vol. 9, 11246, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11246

Palynological and geochemical characterization of Early Silurian "Hot Shales" in Southern Tunisia ("SEREPT" boreholes Tt 1 and Lg 3).

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Uppermost Ordovician through Early Silurian clastic sedimentary sequences in the subsurface of the North Sahara Platform record an important transition from glacial to post-glacial palaeoenvironmental conditions in the Gondwana palaeocontinent. The uppermost Ordovician sandstones represent deposition during a glacial-induced sea level lowstand and are an important hydrocarbon reservoir horizon throughout Algeria, southern Tunisia, and Libya. As a result of the melting of the Gondwanan ice cap, a major transgression occurred during the earliest Silurian, resulting in the deposition of organic-rich black shales across most of Gondwana. These organic-rich sediments are characterized by high values of natural radioactivity, resulting in evident spikes in the gamma-ray logs of the boreholes and their TOC content can be as high as 17%. For these characteristics, the Early Silurian black shales have been termed "Hot Shales". It has been shown that hot shale units constitute the source rocks of large amounts of hydrocarbons in North Africa and peri-Gondwanan adjacent regions. Wells Tt1 and Lg3 in southern Tunisia cut through uppermost Ordovician to Lower Silurian (Ludlow) strata and record the onset of Hot Shales deposition above periglacial sediments, and the return to fine-grained, organically lean clastic sedimentation. The Hot Shales unit is well characterised on the gamma-ray borehole logs, by distinctive ($>$ 200 API) peaks. Palynological and geochemical analyses were performed on the continuous uppermost Ordovician – Ludlow stratal sequences. Palynofacies of the organically lean sediments of Ashgill and Ludlow age are dominated by well preserved and diverse palynomorphs (acritarchs, prasinophytes, chitinozoans, miospores), while structureless, light-coloured AOM is subordinate. The Hot Shale interval is palynologically dated to the late Llandovery-middle Wenlock. The shales are characterized by ex-

tremely abundant AOM which appears to result from the degradation of the phytoplankton; palynomorphs are rare and generally poorly preserved, however, in specific levels, chitinozoans permit precise biostratigraphical age-assessment. Acritarchs, chitinozoans and miospores co-occur in Ludlow palynological assemblage. Measured values of $\delta^{13}C_{org}$ on palynological residues vary from –30.79 to –27.42 (‰ V-PDB) throughout the cored intervals. In borehole Tt1 a "baseline" of $\delta^{13}C_{org}$ values comprised between –30.79 and – 30 ‰ V-PDB is interrupted by two distinctive positive excursions reaching $\delta^{13}C_{org}$ values of –28.28 and –27.42 ‰ V-PDB, one in the late Llandovery to middle Wenlock (coincident with the Hot Shale horizon), and the other in the upper Ludlow, respectively. Because of incomplete sampling, in well Lg3 only the late Llandovery - middle Wenlock excursion is recorded. The observed peaks in the $\delta^{13}C_{org}$ curve may be related to age-equivalent positive $\delta^{13}C$ isotopic excursions (one associated with the so-called "Ireviken" event, and the other with the upper Ludfordian "A period") which are well known in many localities worldwide, and possibly linked to important changes in the global carbon cycle.