# Content of gammacerane in the Paleogene Hetaoyuan Formation in Biyang Sag, East China

Y.G. Hou*, S. He, G.Q. Liu and S.F. Li

Key Laboratory of Tectonics and Petroleum Resources (China University of Geosciences), Ministry of Education, Wuhan, 430074, China
(*correspondence: sporthyg@126.com)

High concentration of gammacerane is ubiquitous in shales and oils of Biyang Sag of Nanxiang Basin, east China. The gammacerane index is negative correlation with the salinity. It decreases rapidly with increasing of palaeo-lake water salinity from 3rd member (Eh32, Eh31) to 2nd member (Eh2) of the Paleogene Hetaoyuan Formation (Figure 1).

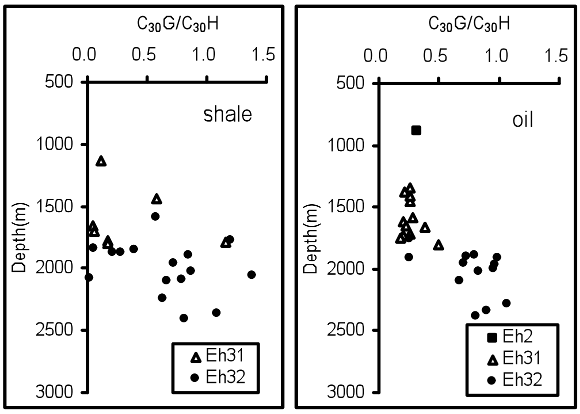

**Figure 1:** Gammacerane index changes with depth in shales and oils in Shuanghe area of Biyang Sag

The relatively high gammacerane index in the brackish water of Eh32 is related to water column stratification due to salinity variation [1-3]. In this case, the adaptability to the water salinity of gammacerane's predecessor is restricted and excessive salinity is unfavourable. It is considered that the reason for the abnormally diminishing of gammacerane index in the higher salinity strata of Eh31 and Eh2 is related to the predecessor of $C_{30}$-hopane reproduces more quickly.

[1] Sinninghe *et al.* (1995) *GCA*, **59**: 1895-1900. [2] Schoell *et al.* (1994) *Geochem*, **21**: 673-683. [3] Zhang *et al.* (1999) *ASS*, **17**(1): 136-140.

---

# Colloidal gold nanoparticles in ore systems

R.M. Hough and R.P. Noble

CSIRO Earth Science and Resource Engineering, Kensington, Perth, WA 6151, Australia

Deposition of supergene (secondary) gold in the regolith is a product of the dissolution of hypogene gold from a primary deposit (hosted by sulphides or quartz), transportation in solution and then re-precipitation elsewhere in the weathering profile. Weathered fracture surfaces, in quartz veins, in saprolite have been observed containing exceptionally rich populations of ultra-thin and nanoparticulate triangles and hexagons of supergene gold crystals. Similarly, gold nanoparticles as spheres have recently been observed in opaline silica accumulations. The single crystals, spheres and ultra-thin gold nanoplates suggest rapid deposition of gold in this environment, completed on the order of days rather than over prolonged timescales, driven by evaporation. This process has been emulated by laboratory experiments, in which similar gold nanoplates have been precipitated by evaporation of gold chloride solutions but also more widely through reactions to reduce gold ligands. The natural nanoparticulate fraction of gold probably occurred as a colloidal suspension before final deposition as metallic particles and raises the question of how common a process is this in all gold depositional settings? Such particles have been imaged in refractory ores hosted in sulphides, in geothermal systems and in volcanic fumaroles but have also been postulated to exist more broadly in epithermal systems and mesothermal quartz veins where amorphous and opaline silica veins occur and are thought to have formed through colloidal processes. As a colloidal suspension, the gold content of the transporting media could reach very high concentrations and may thus be a key process contributing to the formation of high grade gold. Colloids have been observed to be stable to ~400°C but once the colloidal particles interact or lose charge they destabilise and deposit the gold rapidly, as such they can lead to local, very high accumulations of gold.

Direct observations of nanoparticulate and definitively colloidal gold in samples is now possible through advances in element mapping using the new generation Maia detector on the Australian Synchrotron and high resolution microscopy. The distribution of trace and/or fine scale gold can thus be shown over most of a conventional thin section, including at depth.