Mid-Cretaceous terrestrial environments and climates in Hengyang Basin, Hunan province, South China

Li, Xianghui1*, Wang, Jingyu1, Zhang, C.1

1) Nanjing University, Nanjing, China, *E-mail: leeschhui@126.com

The Hengyang Basin is a typical extensional basin within continent, which was formed about 500 km away from the arc island and subduction zones in east between the Asia and Paleo-Pacific plates. Thick terrestrial strata of the Cretaceous through the Paleogene are well documented in the basin, and they are totally over 10,000 m thick, indicating a relatively continuous sedimentation. Of the strata, the Dongjing Formation well outcrops as the lower part in the western Hengyang Basin, providing good chance for intracontinental paleoenvironmental and paleoclimatic study of the mid-Cretaceous.

The investigated 3,000 m cross-section is 3–4 km east to the Baishui Middle School, Hengyang county. The Dongjing Formation is mainly composed of reddish brown fine (para-) conglomerates and mudrocks, intercalated/interbedded with sandstones/graywackes and siltstones. Youngest age populations of detrital zircon from sandstone samples and former spore-pollen biostratigraphy indicate the formation is of the Aptian–Albian.

Field observation shows that lenticular paraconglomerates and graywackes are common; mudrocks are the dominant lithology with gravels, sands, and silts. Particularly, isolated cobbles/pebbles often occur within sandy/silty mudrocks. These lithologies and associations imply that the gravity flowing by muddy, sandy and gravy debris is crucial for the sedimentation. Proximal braded rivers associated pulse floodings could be the main depositional paleoenvironments.

Pedogenesis is another feature for the formation. About 130 calcisols were recognized in about 1,700 m thick stratal succession. The punctuated pedogenic horizons often display in silty mudrocks or muddy siltstones with more or less calcites, which are probably related to subordinate environments such as levee, overbank, split fan, flooding plain, inter-channels. Calcretes are abundant in most calcisols, changing 1–3 %, up to 15 %. They mostly shape in globe, ginger-like, ellipse. They alter in size, from 5 mm to 200 mm. Those small calcretes (5–30 mm) are often developed within few calcic mudrocks, and big ones (50–150 mm) within calcic and harden (silty) mudrocks. Lots of calcisols combined with some gypsum pseudomorphs indicate periodic subaerial environments and hot and (semi-) arid climates characterized the Aptian–Albian in the Hengyang Basin.

Carbon isotope of ~130 calcrite horizons shows that δ¹³C are -3‰ to -8‰, mainly -5‰ to -7‰, compatible with those from published data. About ten distinct cycles of increasing-decreasing δ¹³C are distinguished. pCO₂ concentrations from the calcrite δ¹³C are estimated as 500–2,500 (mainly 1,000–2,000) ppmV, and cyclic perturbations of pCO₂ concentration perhaps imply an astronomical control. High and cyclic pCO₂ concentrations support hot and arid climate by sediments.