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Genesis of the high gamma sandstone of the Yanchang Formation in the Ordos Basin, China: A reply

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Abstract: The authors of 'Genesis of the high gamma sandstone of the Yanchang Formation in the Ordos Basin, China' questioned the viewpoint that high-gamma-ray sandstone might be caused by homochronous sedimentary volcano tuff ash or previous tuff. The authors argued that the main reason for the high-gamma-ray sandstone should be from high Th and U contents in zircon. In reply, we discuss the problems with the authors from the category of high-gamma-ray sandstones, rock characteristics, and possible sources of radioactivity. The results still indicate that the high gamma ray characteristics might be caused by homochronous sedimentary volcano tuff ash or reworked previous tuffs.

Key words: High-gamma-ray sandstone, provenance, event deposit, Yanchang Formation, Ordos Basin

1 High-gamma-ray sandstone category

High-gamma-ray sandstone refers to sandstone with low mud content but with higher gamma ray than normal, that is, those sandstones where the high-gamma-ray is not caused by mud content (Zhang et al, 2010). According to the characteristics of logging curves and the core analysis of Fig. 1 in Liu's paper (Liu et al, 2013), the well section from 1,889 to 1,893 m in well y91 is a conventional sandstone. However, the gamma ray count increases significantly in the underlying 5 m, from 1,893 to 1,898 m. The high-gamma-ray sandstone between 1,893 and 1,898 m may be due to an increased content of clay minerals such as chlorite, reticulate clay minerals and mildly radioactive minerals such as muscovite. The reasons are as follows:

1) Compared with the well section from 1,889 to 1,893 m in well y91, the logging curve characteristics of the well section from 1,893 to 1,898 m are higher gamma ray value, smaller spontaneous potential amplitude, higher compensated neutron log value, lower density, higher AC (acoustic logging) value, and smaller amplitude between dual induction curves and focused resistivity curves. It is inferred that the logging characteristics changes in the well section from 1,893 to 1,898 m may be derived from the increase of clay mineral content and radioactive mineral content. Because Table 2 in Liu's paper (2013) did not provide detailed core thin section data, only the thin section data in 1,894.27, 1,895.31 and 1,895.65 m, it can be found that the muscovite content is high in lithic fragments, and the chlorite, reticulate clay (includes montmorillonite and mixed layer illite/smectite) and mica contents are high in interstitial material.

2) The core thin section analysis of high-gamma-ray sandstone from 1,893 to 1,898 m in well y91 shows that the compositions of the sandstone are quartz and feldspar, and their contents are 22%-28% and 40%-46% respectively. Lithic fragments are mainly mica, phyllite and dolomite and the interstitial materials are mainly chlorite and reticulate clay. Then, how many types of feldspar are there and what are their proportions?

3) Liu's paper (2013) did not provide gamma results separately for U, Th and K in core from well sections 1,893-1,898 m and 1,889-1,893 m in well y91, so we do not know if the radioactive source of high-gamma-ray sandstone in well section 1,893-1,898 m is mainly U, Th or K or a mixture of all. Hence one cannot conclude definitely that the radioactive source of high-gamma-ray sandstone was the high content of Th and U in zircon.

Therefore, we suggested that the radioactive source

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