# Si and O isotopic evidence for the genesis of the secondary quartz in red weathering crusts of carbonate rocks in Guizhou Province

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In our previous study, the well-crystallized quartz had been founded in many in situ weathering crusts of carbonate rocks in Guizhou Province, which have been demonstrated the possibility of dating the weathering processed by the method of fission track dating. So, the genesis of the well-crystallized quartz is the key to date the weathering crusts of carbonate.

This paper focuses on the use of the ratio of $\delta^{18}O$ and $\delta^{30}Si$ of well-crystallized quartz, extracted from in soil layer of three weathering crusts. The ratios of$\delta^{18}O$ of well-crystallized quartz have a narrow range from 17.3-22.7‰ ( SMOW ) , which were more positive than igneous rocks (8-10‰), metamophic rock (10-16‰) and Hydrothermally modified rock (4-10‰), similar to the chert bearing in the low temperature-formed dolomite (14-24‰) and authigenic quartz (20-34‰) in sandstone in Mississippi river, implying the supergene genesis of well-crystallized quartz. Furthermore, the ratios of $\delta^{30}Si$, ranging from 0.8‰ to 1.7‰, were more positive than the crystalline rock, kaoline, diatomite and quartz veins, but overlap the shallow marine radiolarian-bearing siliceous rocks and siliceous dolomite, which implied the quartz were precipitated in low-temperature environment too. Based on the Si and O isotopic evidence, it is deduced that the well-crystallized quartz was secondarily precipitated from Si-rich weathering fluids during weathering processes of carbonate rocks.

According to the argillaceous soil layer lacking of enough space for the precipitation of quartz and well-crystallized quartz was founed in small cave or cranny underlying parent rock in field, it can be confirmed that the quartz was pricipiated in parent rock. That is to say, the age of secondary well-crystallized quartz in soil layer was the upper limit or oldest age of weathering processes of carbonate rock in Guizhou Province.

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# Revised petroleum migration history in the Nanbaxian area of the northern Qaidam Basin (NW China): Constraints from oil-bearing fluid inclusion analyses

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The Nanbaxian area is the presently largest oil-gas producing provinces in the northern Qaidam Basin, NW China. Previous studies have suggested only the northern Middle Jurassic sources mainly feed the reservoir here, with little contribution from the southern Lower Jurassic mudstone. In this study, we obtained new insights on petroleum migration history based on analyses on hydrocarbon fluid inclusions.

Free oil in intergranular pores and petroleum in inclusions hosted by mineral grains of reservoir sandstone samples were analyzed by GC and GC-MS. Analytical results show that there is a distinctive difference of molecular geochemical signatures between the free and inclusion oils, including the peak carbon number present in GC chromatogram, the ratio of pristane relative to phytane, etc. Specifically, the value of tricyclic terpane $C_{19}/C_{20}$ was suggested as good oil-oil and oil-source correlation proxy by previous authors. Thus, as this value is greater than and lower than 1.0 for free and inclusion oils, respectively, we proposed that there were at least two oil charges ever happened, with the Middle Jurassic mudstone derived hydrocarbons charging firstly and the Lower Jurassic oils arriving later.

Petrography shows that there mainly exist three different fluorescence color hydrocarbons: yellow, yellow-green and brown orange. This indicates a complex petroleum charge history. The histogram of Th data shows three populations with modes at around 60°C, 70-80°C, and 100-110°C. Combined with the burial and paleotemperature history, this reveals that there include mainly two oil charge episodes in Early and Late Paleogene, respectively. In addition, the highest Th range (100-110°C) was indicative of gas charging during Neogene.

In summary, petrographic and geochemical investigations of oil-bearing fluid inclusions tend to suggest a revised petroleum migration history. The complexity here may be attributed to the two hydrocarbon source kitchens and the effect of fault-controlled petroleum migration.