The young basalts on the Moon: Pb–Pb isochron dating in Chang'e-5 Basalt CE5C0000YJYX03501GP

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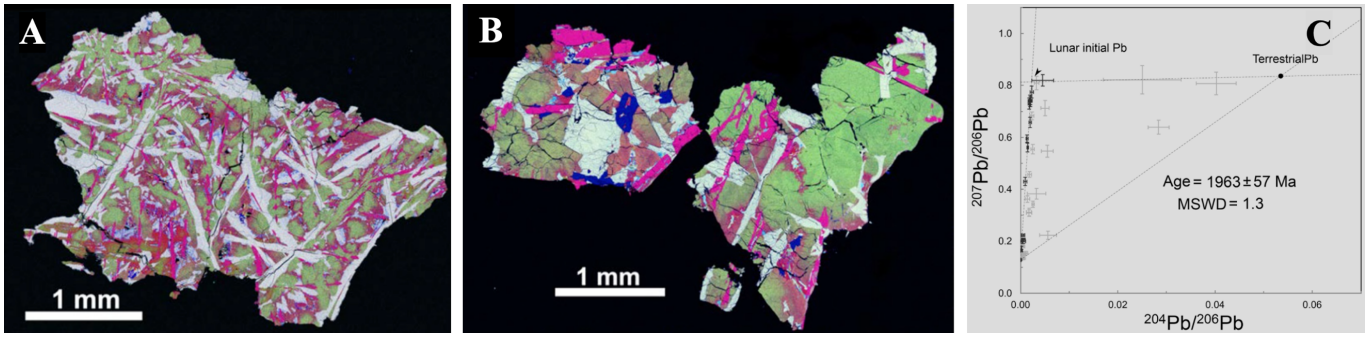

Figure 1. A & B false color energy EDS element maps of the two fragments from CE5C0000YJYX03501GP blue=silica, green=Mg, red=Fe, white=Al, yellow=Ca, pink=Ti, cyan=K. C Pb-Pb isochrons for CE5C0000YJYX03501GP.

China's Chang'e-5 mission collected 1731g lunar samples at 43.1°N, 51.8°W in the northeastern Oceanus Procellarum of the Moon. Basalt fragments is the main lithic type in the lunar soil returned by Chang'e-5 that showed five distinct textural types[1], The two scooped basalt fragments from CE5C0000YJYX03501GP both are equidimensional, approximately 3-4 mm in size and consist of clinopyroxene, plagioclase, olivine, ilmenite, quartz, cristobalite, K-rich glass, barian K-feldspar, troilite and Ca-phosphates, with small amounts of the Zr-rich minerals baddeleyite and zirconolite[Figure 1. A, B]. The pyroxenes and olivines in the two fragments include highly Fe-rich compositions for lunar basalts. and the bulk compositions of both fragments indicate elevated FeO (~22-25 wt.%) and low MgO (~5 wt.%). The mineralogy and bulk compositions of two basalt fragments are consistent with remote sensing data of this region [2]. These 677 ± 3 of $^{238}U/^{204}Pb$ ratio (μ-value) for the two fragments imply only a modest (<2%) KREEP component either in their mantle sources or introduced by assimilation during magma ascent [2].

The Pb isotope data were collected using a SHRIMP IIe-MC at Beijing SHRIMP Center, Institute of Geology, Chinese Academy of Geological Sciences, Beijing. $^{204}Pb^+$, $^{206}Pb^+$, $^{207}Pb^+$ and $^{208}Pb^+$ isotopes were measured simultaneously with multi collectors and the $^{204}Pb/^{206}Pb$, $^{207}Pb/^{206}Pb$ and $^{208}Pb/^{206}Pb$ ratios were calibrated using BCR-2, BHVO-2. Combining all Pb isotope data from Zr-rich minerals, Ca-phosphates, K-rich glass and barian K-feldspar for the two basalt fragments, gives an isochron age of 1963 ± 57 Ma [Figure 1. C]. This age constrains the lunar impact chronology of the inner Solar System and the thermal evolution of the Moon. Studies of other basalt fragments from Chang'e-5 have yielded similar results [3, 4], and showed a relatively low water content [5].

Reference

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