

PB ISOTOPES IN TROCTOLITE 76535; W.R. Premo and M. Tatsumoto, U.S. Geological Survey, MS 963, Box 25046, DFC, Denver, Co. 80225

Pristine lunar plutonic rocks may provide evidence of a primitive lunar Pb isotopic composition and U/Pb ratio acquired during lunar formation [1]. Lunar troctolite 76535, thought to be relict, ancient, deep-seated lunar crust, has been described as "a coarse-grained, olivine-plagioclase cumulate [2]. The original mineralogy is reported to contain ~ 35% plagioclase, ~ 60% olivine, and ~ 5% low-Ca pyroxene (bronzite) with minor high-Ca pyroxene, Cr-spinel, K-Ba feldspar, pyrochlore, Fe-Co-Ni metal, apatite, baddelyite, and whitlockite. Our subsample, however, contained ~ 65% plagioclase, ~ 30-35% olivine, and < 5% pyroxene and other minor phases. Three separates were hand-picked and include plagioclase (PL-1 & PL-2) and an olivine-pyroxene mixture (OL-P). The whole-rock (WR) consists of the fine-grained, unpicked material. These separates were first treated with alcohol, then very dilute acids, in order to remove any terrestrial contamination and strip the grain surfaces of any adsorbed Pb component [3]. The remaining Pb in the residues should ideally represent initial Pb incorporated during noritic cumulate formation as well as radiogenic Pb that has since accumulated from the in situ decay of U and Th.

The Pb isotopic data from the residues of leached separates (solid circles) are shown in the figure below, and are compared with the radiogenic Pb from whole-rocks of other pristine plutonic rocks 78235 [4], 15415 [5,6] and 67075 [7] (open circles), two separates (plagioclase and WR, solid diamonds) also of 76535 [8], washes and leaches of 76535 (this study, small solid triangles), and terrestrial contamination given by our laboratory Pb composition (blank Pb, small cross). The Pb from all 76535 residues is radiogenic (measured $^{206}\text{Pb}/^{204}\text{Pb} > 140$), plotting near the ordinate, and form a trend (dashed line) between PL-2 and OL-P towards the radiogenic Pb composition found in 15415 and 67075. These results are very similar to those of 78235 [4]; and, in fact, the Pb-Pb isochron ages (intersection with the ordinate) for both 78235 and 76535 are essentially identical at 4276 ± 15 and 4279 ± 175 Ma, respectively. The age for 78235 was interpreted as a minimum estimate for the norite as the combined U-Pb data showed that the rock had been disturbed during a shock-melt event at ~3.95 Ga [4]. The chord connecting the residues of 76535 is a mixing line between the composition of the radiogenic Pb accumulated from the in situ decay of U since the rock crystallized (possibly since a disturbance to the rock) and the composition of the common Pb incorporated in the rock at the time of its formation. The composition of the radiogenic Pb is given by OL-P, which apparently contains very little, if any, common Pb. The other separates, WR and PL-1 & 2, are mixtures of common and radiogenic Pb. The composition of the common Pb may be given by the Pb in 15415.

It is probable that troctolite 76535 is older than 4.28 Ga, as norite 78235 turned out to be 4.34 Ga [9] (possibly as old as 4.43 Ga [10]) but experienced a metamorphic event that disturbed the U-Pb system at some as yet unknown age. A chord between the two largest separates (PL-1 & 2) intersects the ordinate, defining an age of 4388 ± 30 Ma.

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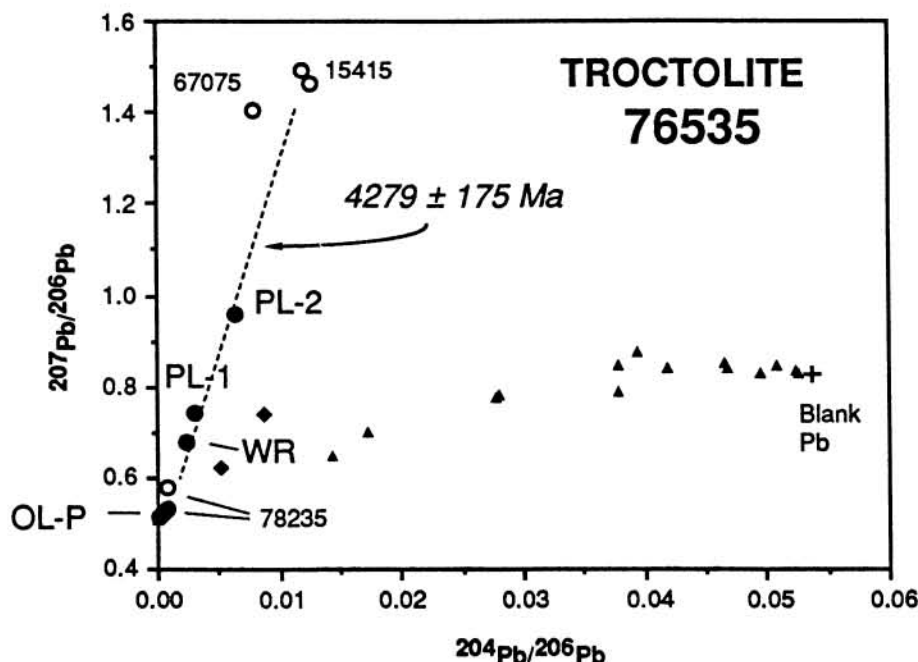


Fig. 1: Pb-Pb correlation diagram showing the behavior of residues, washes, and leaches from analysis of lunar troctolite 76535. A trend (dashed line) is defined by the residues, identifying a minimum age for the troctolite at 4.28 Ga and a source Pb composition similar to that found in anorthosites 15415 and 67075.

Presently, we are analyzing the U and Th from all the residues, washes and leaches of 76535 (to be presented at the conference) in order to better define the age(s) of crystallization and metamorphism. The only U-Th analysis thus far indicates that the WR separate is slightly discordant at 4.68 Ga using CDT initial Pb values [11]. A more reasonable U-Pb age can be calculated using the initial Pb values ($6/4 = 44.19$ and $7/4 = 74.84$) determined for norite 78235 at 4.34 Ga [4], which alters the WR Pb-Pb concordia age to 4.44 Ga. This age is identical to that for ferroan anorthosite 60025 [12]. If we use the Pb composition of 15415 as the initial Pb for troctolite 76535, the WR separate is more discordant, but does indicate a Pb-Pb concordia age of 4.22 Ga, which is very similar to a Sm-Nd age of 4.26 ± 0.4 Ga reported by [13].

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