A review of the analytical accuracy of Cl isotope measurements in rocks by various techniques: A way to explain inconsistency between results

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There are large inconsistencies between various Cl isotope values found for silicate rocks. Notably, mantle $\delta^{37}Cl$ is +4.7‰ [1] to near ~ 0‰ [2] and ≤ -1.6‰ [3,4], implying very different conclusions about the Earth's Cl budget and geodynamics. Each value was obtained with different analytical methods (TIMS, dual-inlet IRMS, continuous flow IRMS, SIMS). Although all use the same reference for waters (SMOC), silicate measurements require Cl extraction from the rock and only one study checked the validity of the whole analytical procedure [5]. In the absence of international rock reference materials, we analysed at IPGP two rocks 15 and 7 times in different sample sizes as well as GSJ materials provided for possible inter-lab calibrations [5]. Although less sensitive than the continuous flow technique used at University of New Mexico (UNM), the IPGP dual-inlet IRMS method is more precise and gives 100 ± 8% overall Cl yields and ± 0.12‰ $\delta^{37}Cl$ reproducibility for Cl extracted from 39 to 9042 ppm Cl rocks [5] (ie., the range of mantle-derived samples analysed [3]). Large analytical Cl isotope fractionations result from non-quantitative Cl yields (Fig. 1 in [5]). There is now a global agreement that some TIMS data in [1] are unreliable [5,6]. It is hard to evaluate discrepancies between IPGP and UNM data, as there are only few details reported for UNM method validation. The only yields reported are too high: 124 ± 17% for >1000ppm Cl samples [7]. More importantly, a new lab using an independent extraction method [8] recently reproduced the IPGP values on 3 rock samples (JB1, JB2 & Allende) – while UNM produced a 2‰ more positive value for Allende. Thus, the observed discrepancies possibly might arise from analytical artifacts in the UNM method and therefore the mantle is depleted in ^{37}Cl.

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Neoproterozoic to Mesozoic history of Sanandaj-Sirjan Zone, West Iran

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Neoproterozoic tectonics is documented by U-Pb inherited zircons of Sanandaj-Sirjan Zone (SSZ) granitoids, West Iran. The 0.989 Ga inherited zircon of Malayer Syenogranite [1], Northern SSZ, is in accordance with combination of the supercontinent Rodinia at ca. 1.0 Ga. The collision between East and West Gondwana between 0.6 and 0.5 Ga is also could be pursuit by other granitoids of the SSZ which are implied a ca. 0.55 Ga. for Bubaktan biotite granite and Sheikh Chupan granodiorite [2] and ca. 0.59 Ga for Nagadeh monzogranite [3]. The magmatism at Late Neoproterozoic-Early Cambrian in SSZ [2, 3, 4] which is consistent with Pan-African orogenic event, implies that this zone was a part of Gondwana at that time.

Subsequent extension regime in Paleozoic caused rifting of Iranian microplates including SSZ away from Gondwana. Closure of Paleotethys due to its northward subduction and the synchronous opening of the Neotethys in the Late Triassic move Iranian microplates northeastward and accrete them to the Laurasia. Closure of Neotethyan oceanic crust re-amalgamated Iranian blocks at the late Mezosoic. The immense Paleozoic-Mezosoic plutonism in SSZ is the result of this opening and closure of Pale- and Neotethys.

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