

## The great volatile delivery to Earth

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The <sup>206</sup>Pb/<sup>204</sup>Pb and <sup>207</sup>Pb/<sup>204</sup>Pb ratios of the BSE indicate that Pb has been *depleted* with respect to U at some time  $T_1$  after the beginning of the Solar System and raises the question of where the missing unradiogenic Pb resides. The Earth's gravity field is too strong for heavy Pb vapor to escape thermally. Pb has been either lost to space upon hit-and-run impacts or buried into the core, with the effect that the U/Pb ratio of the BSE has increased over time. The present Pb composition of the BSE requires that the U/Pb fractionation *increased* at  $T_1 > 140$  Ma after the formation of the Solar System. This age postdates the oldest lunar rocks [1] and also any Pb burial into the core during the lunar Giant Lunar Impact [2]. We suggest that both the proto-Earth and the Moon were extremely depleted in volatile elements, whether siderophile or not, because accretion ended while temperature was still high.

Chondritic impactors ('late veneer') dislodged from their orbits in the outer Solar System account for the strongly siderophile inventory of the BSE [3] and also explain well the late delivery of Pb and other volatiles, notably water [4]. The issue of how the impactors' U and Pb became fractionated from each other nevertheless still is outstanding. High-velocity impacts of asteroids on the Earth lead to total melting and partial vaporization of the impactors [5]. The vapor produced by impacts eventually rains back onto the Earth upon cooling, whereas molten metal separates from silicates either as diapirs or as metal rain [6]. The siderophile content of the BSE hence is accounted for by the vaporized fraction of the veneer, while the bulk of the impactor's non-siderophile volatiles adds up to the volatile content of the Earth. Using Ballhaus *et al.*'s (this meeting) metal/silicate partition coefficients, we find that 8% volatilization of a late veneer equivalent of up to 5% of the Earth's mass with metal/liquid segregation at 1600 K reproduces well the trace element concentrations in BSE. We find that 70% of Pb and Cd, 80% of Sn, 50% of W, and 7% of Cr in BSE come from the impactors. A late veneer with a rather unremarkable mean water content of ~1% adequately accounts for the terrestrial water inventory.

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## Behavior of mercury in thermal sources of Kamchatka

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For the first time for a deep-seated source of thermal waters (Kamchatka, operational holes of the Mutnovsky Geoelectric power station) are analysed compositions co-existing steam-and-gas and liquid phases and for temperatures 180 – 200 °C, the molal distribution coefficient of mercury in system a steam-liquid is defined. Results have shown, that in samples of deep-seated fluids (the borehole bottom on depth 1600) dominates the elementary mercury enriching steam-and-gas phase with the big distribution coefficient (8,17) in favour of vapour phase. Analogous results are gained on a considerable quantity of samples of other thermal sources at simultaneous selection of a liquid phase and a condensate of steam-and-gas. Results on mercury compared with distribution coefficients of other microelements.

By data in paper [2, 3] the highest content of mercury in a gas phase is fixed on an exit of Apapelsky sources 75000 ng/m<sup>3</sup> this result is in the contradiction with the size of a Henry's coefficient defined in paper [4] and with our data. For check and the coordination of results of these works direct measurements of mercury contents in steam-and-gas phase by the instrumentality of field atomic absorber UCM-IMC (ECON, Moscow) was realized and the thermal waters of Apapelsky sources and condensates was collected. High values of contents of mercury in condensates are in the obvious contradiction with concentration of mercury in a water phase of thermal sources and can be explained only considerable enrichment of condensates of water steam by mercury of a gas phase, i.e. its carrying over in the aerosol form.

By our results and by results described in work [1] for system of a caldera of Uzon high concentration of mercury (up to 11 ppb in Chloride Lake) not only in a steam-and-gas phase, but also in sodium chloride waters are characteristic.

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