Study of Naryn river (Central Asia) runoff formation by stable isotope

A.A. SAMSONOVA[1]* AND I.V. TOKAREV[2]

[1]IWPH NAS KR, Bishkek, 720033 Kyrgyz Republic (aasamson@yandex.ru)
[2]SPbSU, Sredniy 41, of. 519, Saint-Petersburg, 199004 (*correspondence: tokarevigor@gmail.com)

Monitoring of the isotope composition ($\delta^{18}O$, δ^2H) of precipitations, Naryn river and its tributaries, groundwater, and Toktogul reservoir was carried out in 2007-2009. Isotope composition of precipitations vary from $\delta^{18}O = -1.2$ and $\delta^2H = -17$ ‰ to $\delta^{18}O = -26.5$ and $\delta^2H = -206$ ‰ and fits the global meteoric water line. Mean seasonal composition of precipitation in summer (Jun.-Jul.-Aug.) is $\delta^{18}O = -9.5$ and $\delta^2H = -70$ ‰; in spring (Mar.-Apr.-May) is $\delta^{18}O = -11.6$ and $\delta^2H = -83$ ‰, in autumn (Sep.-Oct.-Nov.) is $\delta^{18}O = -11.0$ and $\delta^2H = -79$ ‰, in winter (Dec.-Jan.-Feb.) is $\delta^{18}O = -17.3$ and $\delta^2H = -130$ ‰.

End-member isotopic compositions varies: a) Naryn river head $\delta^{18}O = -15.2$ and $\delta^2H = -134$ ‰ to $\delta^{18}O = -10$ and $\delta^2H = -82$ ‰; b) middle reach of Naryn river and its tributaries $\delta^{18}O = -10.9$ and $\delta^2H = -79$ ‰ to $\delta^{18}O = -14.5$ and $\delta^2H = -104$ ‰; c) Toktogul reservoir $\delta^{18}O = -14.1$ and $\delta^2H = -103$ ‰ to $\delta^{18}O = -11.8$ and $\delta^2H = -84$ ‰; d) groundwater $\delta^{18}O = -17$ and $\delta^2H = -126$ ‰ to $\delta^{18}O = -13$ and $\delta^2H = -94$ ‰. The average isotopic composition of Naryn river just before flowing into the Toktogul reservoir is $\delta^{18}O = -13.0$ and $\delta^2H = -93.2$ ‰, and in the reservoir itself – $\delta^{18}O = -13.0$ and $\delta^2H = -94.4$ ‰; both are close to the mean annual precipitation $\delta^{18}O = -12.8$ and $\delta^2H = -92.5$ ‰. Consequently, there is strong averaging of precipitations in the some reservoirs, and averaging increases with runoff.

Naryn river runoff practically has no the glacier water, because of a) isotopic composition of water in rivers is weighted in summer and lighted in winter; b) water isotopic composition in the middle reaches is heavier, than in river head, where water has moreover fingerprint of cryogenic metamorphism in isotope composition; c) river water significantly differs from the isotopic composition of ice cores on the Inylchek glacier $\delta^{18}O = -16.5$ and $\delta^2H = -105$ ‰.

In conclusion, Naryn river runoff is formed at the expense of winter and spring precipitations. Summer precipitations can be neglected, as their volume is insignificant, and at altitudes to 1600 m precipitations are completely absorbed by evaporation. Disappearance of glaciers won't render essential influence on a river Naryn runoff.

The breakup and chemical equilibration of metal diapirs in terrestrial magma oceans

HENRI SAMUEL

Bayerisches Geoinsitut, Universitaet Bayreuth (henri.samuel@uni-bayreuth.de)

The early history of the Earth is most likely marked by at least one global magma ocean stage. During this time window, iron diapirs of various sizes delivered by differentiated impactors may have plunged through a few hundred kilometer thick silicate magma ocean. Understanding the breakup of metallic cores in such context is key to constrain the degree of metal-silicate equilibration processes.

To address this problem, I have conducted a series of numerical experiments where I follow the sinking of iron diapirs until breakup. These models include an accurate treatment of surface tension, inertial effects, stress and composition dependent viscosity. The influence of rheological properties and diapir sizes was systematically investigated. Scaling laws for the conditions of diapir breakup have been derived and are used to determine the stable size of sinking iron bodies in a silicate magma ocean.

Using these relationships I investigate the conditions and timing for metal-silicate chemical equilibration in terrestrial magma oceans.