Martian rover “Spirit” discovers basaltic and alkaline rocks with limburgite (basanite) geochemical tendencies characteristic of high standing tectonic blocks of Earth

G. Kochemasov

IGEM RAS, 35 Staromonetny, 119017 Moscow, Russia (kochem@igem.ru)

Tectonic dichotomy of terrestrial planets requires subsided segments to be filled with denser material than uplifted ones [1]. This is for equilibrating angular momenta of hypsometrically (tectonically) different levels blocks building one rotating body. At Earth in addition to “light” continents (on average of andesitic composition) and “heavy’ basaltic oceans there is a substantial chemical difference between basaltic layers of both tectonic settings. Basalt flows on continents (plateau basalts) always are a bit less dense than basaltic infillings of oceans. This is imprinted in their chemistry. The continental flood basalts (CFB) are more alkaline and have higher Mg/Fe ratio (composing them color minerals are less ferriferous or less dense). Even sharper difference one would expect for the martian case because Mars with its twice lower orbital frequency has a sharper relief range ($\sim$6 km hypsometric difference between the northern lowlands and southern highlands) that requires a sharper density difference between composing these blocks lithologies. Earlier predicted [2] alkaline lithologies for continents were found at Columbia Hills highland outlier [3] – finely layered 100 m high massif with typical for terrestrial alkaline (and UB-alkaline) massifs sharp alkaline magma fractionation. At very short vertical distance in Columbia Hills there is an alternation of rocks with high and low Fe contents, olivine-rich and olivine-poor, rich and poor in plagioclase, with “normal’ and high abundances of P, S, Cr and so on. It is characteristic that APXL analyses detect Y [4]. Normally this element accompanies rare earth elements that have special minerals in alkaline rocks in ensemble with Ti, Nb. Ti and P enrich some Columbia Hills layers. Y in terrestrial conditions is often found in phosphate xenotime. Basaltic rocks of Gusev crater (near the continent) could be compared with Vikings’ basalts (“open ocean”). As it should be, in Vastitas Borealis basalts are Fe rich or Fe-basalts. They are less siliceous, have less K, Mg and Al. Gusev crater basalts have higher Mg/Fe, AL/Ca, K_2 0 (up to 0.5%, especially in soils, even 0.7% in Pathfinder andesites also in the contact). All indicates that approaching highlands basalts become “lighter’ as it requires physics of a rotating body. Si, Mg, Na, K enrichments are characteristic for typical terrestrial highland (continent) region – South Africa where in flood basalts of the Lebombe monocline (Mozambique) appear limburgites (basanites) –special basalts enriched in Mg and K. References: **[1]** Kochemasov G. G. (2004) Mars and Earth: two dichotomies – one cause. In Workshop on “Hemispheres apart: the origin and modification of the martian

crustal dichotomy", LPI Contribution # 1203, Lunar and Planetary Institute, Houston, p. 37. **[2]** Kochemasov G.G. (1995) Golombek M.P., Edgett K.S., Rice J.W.Jr. (eds) Mars Pathfinder landing site workshop II: Characteristics of the Ares Vallis region and Field trips to the Channeled Scabland, Washington. LPI Tech. Rpt. 95-01, Pt. 1, LPI, Houston, 63 pp. **[3]** McSween H.Y., Ruff S.W., Morris R.V. et al. (2006) Backstay and Irvine: alkaline volcanic rocks from Gusev crater, Mars // LPSC 37, abstr.1120, CD-ROM. **[4]** Clark B.C., Gellert R., Ming D.W. et al. (2006) PYTi-NiCr signatures in the Columbia Hills are present in certain martian meteorites // LPSC 37, abstr.1509, CD-ROM.