Analysis of trace elements in glass and pyroxene by LA-ICP-MS: Results from the rhyolitic ashfall and ashflow tuffs of the Bruneau-Jarbidge eruptive center, Yellowstone hotspot track

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Trace concentrations of 37 elements were measured in individual glass shards and pyroxene crystals from the multiple eruptive units of the 12.7 – 10.5 Ma Cougar Point Tuff (CPT) of the central Snake River Plain, Idaho, USA, including glass from ashfall and pigeonite and augite crystals from ashflow deposits. The rhyolitic CPT is recognized for its polymodal assemblages of both glass and minerals within individual units, for the recurrence of these distinctive polymodal assemblages in different eruptive units, and for sustained high magma (900-1000°C) temperatures. *In situ* trace element analyses by LA-ICP-MS demonstrate that individual compositional modes of glass and pyroxene that recur in different units, and that are indistinguishable from one another with respect to major and minor elements, in fact have distinct trace element abundances and thereby afford a means of fingerprinting individual units as well as provide evidence against a xenocrystic (or antecrystic) heritage for minerals. Pyroxene-melt and pigeonite-augite partition coefficients are presented for Sc, V, Cr, Co, Ni, Zn, Sr, Y, Zr, Hf, and all REE but Tm. Glass in fallout ash of the CPT ranges over 72–75 wt % SiO_2 and 1.8–2.6 wt % Fe_2O_3 and the multiple glass modes fall broadly into two groups according to Fe content. Pyroxene-melt KDs are determined from glass-mineral pairs in tuffs and lavas that bear homogeneous, unimodal glass from the low Fe group and unimodal compositions of unzoned pyroxene. Units that are bimodal with respect to glass (i. e. high and low Fe components) and pyroxene provide a basis for estimating mineral-melt partition coefficients involving the high Fe glass. This study suggests that partition coefficients vary between the two groups, and are function (s) of temperature and/or composition. Pigeonite-augite partition coefficients determined from multiple sets of equilibrium mineral pairs remain constant over the observed range of compositions and temperatures. Calculated mineral-melt partition coefficients applied to glasses of subtly different compositions successfully predict the observed range of trace element compositions of pyroxene, permitting a framework for assigning mineral modes to glass modes in heterogeneous assemblages, a task previously hampered by the absence of pumice in both ashflow and ashfall deposits of the central Snake River Plain.

Abiogenic-biogenic bases of the genesis and synthesis of natural hydrocarbons in the Earth's lithosphere (by fluid inclusions research)

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Conditions and processes of generation of the greater part of useful minerals are clearly fixed by fluid macro- and microdefects (in particular, and by fluid inclusions), first of all, in veinlet-impregnated minerals [1]. Proceeding from the created basis of knowledge about 'thermobarometry and geochemistry of gases of veinlet-impregnated mineralization in deposits of oil-gas-bearing areas and metallogenic provinces' [2] we were able to solve and explain from new dualistic (abiogenic-biogenic) positions both hydrocarbon synthesis with their genesis and formation of actually veins and impregnates in the Earth's crust.

It was shown that a mechanism of hydrocarbon synthesis in natural processes of oil-gas formation can be realized only in the deep-seated faults of the Earth's lithosphere in the environment of deep-seated high-temperature fluid [3]. On the basis of present physical-chemical model it was stated that this deep-seated high-temperature fluid is actually the principal, the main and the important source of powerful energy as soon as sufficient enough amounts of initial substances for synthesis of hydrocarbon in its medium.

The scientific novelty of a new dualistic (abiogenic-biogenic) theory of synthesis and genesis of natural hydrocarbons (oil, gas etc.) [4] is based on elucidated wholly new and unaccounted up to now natural phenomena such as the generation of an appearance of additional powerful adiabatic compression of fluid and high-voltage electric field, the formation of tectonic macro- and micro-cracks and various submicrodefects in solids, the creation of oxidizing-restorative reaction medium, the synthesis of hydrocarbons and the formation of oil and gas fields (deposits), the formation of veinlet-impregnated mineralization etc. This differs it principally [1] both from now prevailing theories and other notions of the origin of natural hydrocarbons and the formation of their fields (deposits) in the Earth's crust.

[1] Naumko (2006) Doctoral thesis, p.52. [2] Svoren' *et al*. (1994) *Geol. & Geochim. Combust. Minerals* **3**–**4**(88-89), 54–63. [3] Naumko & Svoren' (2003) Moscow, *IPNG* 62–63. [4] Svoren' & Naumko (2006) *Rep. of the NAS of Ukraine* **2**, 111–116.