Hydrothermal-sedimentary lithogenesis

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The model of the hydrothermal-sedimentary lithogenesis rests on data of suspended and settled matter of 'black smokers', proximal and distal metalliferous sediments (MS), as well as the Paleozoic hydrothermal-sedimentary deposits. Recent hydrothermal fields (Broken Spur (<1 kyr), TAG (~40-50 kyr), Krasnov (~120 kyr), Semenov ore cluster (~37-124 kyr)) and ancient VMS deposits of the Urals (Molodezhnoye, Yaman-Kasy, Safiyanovskoe) was selected as an illustration of the model. Moreover, the manganiferous deposits of the Urals (Kyzil-Tash, South-Faizulinskoe, Bikkulovskoe) was also included in this model as an ancient propotype of distal hydrothermal-metalliferous sediments.

On the basis of study of sediment strata on the Krasnov field [Rusakov *et al*., 2011; 2012] and Semenov ore cluster [Rusakov *et al*., 2013 in press] was found that epicenter part of the hydrothermal-sedimentary strata in form of ore-bearing sediments, covered ore-bodies, reflects a zone of interrelation between ore-bearing solutions (infiltration-metasomatic processes) and seawater (halmyrolysis). At the distance of the zone the ore-bearing sediments are transformed into proximal MS, ore part of which is completely presented by Fe-oxyhydroxides. Main part of Mn is precipitated on great distance from the hydrothermal field from non-buoyant plumes.

On the basis of study of ferruginous rock around VMS deposits enable to reveal main stages of the meta-sediment formation: (1) sedimentation, (2) infiltration-metasomatic, (3) halmyrolysis, (4) lithification. The infiltration-metasomatic impact of hydrothermal solutions and oxidizing action of seawater leads to copper redistribution within sediment strata and formation of secondary minerals (pyrite is replaced by chalcopyrite, chalcopyrite is replaced by siderite, as well as formation of secondary calcite and chlorites). The main mechanism of lithification of MS is sediment dehydration, expressed in replacement of Fe-oxyhydroxides by hematite and silica by quartz. In spite of such transformations, original lateral zoning of rock is remained indicating on effect of hydrothermal-sedimentary genesis.

Origin of Earth's Earliest Continental Crust: A Combination of Partial Melting and Fractional Crystallization?

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The origin of tronalite-trondhjemite-granodiorite (TTG) plutonic complexes continues to be a major focus of research as these suites make up a majority of Earth's earliest continental crust. Partial-melting experiments were conducted (at 900-1100 ºC and 0.5-3.0 GPa) on two greenstones from the Nuvvuagittuq Complex, Quebec, Canada and on PC-103, a 3.66 Ga tonalite that encloses the mafic rocks of the Nuvvuagittuq Complex. At 1.5-3.0 GPa and 950-1100 ºC, the experimentally produced melts are compositionally similar to Archaean TTGs (including PC-103). But the degree of melting needed to produce these melts is high (> 30 %) and so the relative concentrations of most incompatible elements in the melts are similar to those of their greenstone parent rocks. These greenstones have compositional affinities with modern subduction zone magmas. Thus, arc-like mafic rocks appear to have been selectively involved in TTG formation, implying the involvement of crustal recycling in TTG genesis. The results of experiments on the tonalite PC-103 suggest either equilibrium of its original magma with a garnet pyroxenite residue at ~1050 °C and 3.0 GPa, or compositional control by the plagioclase-pyroxene cotectic at ≤ 900 °C and < 1.0 GPa. The latter option is more consistent with the compositional trends of Archaean TTGs. In either case, a high degree of inheritance is involved implying a role for early crustal recycling.

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