Gallium in bauxite deposits

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Gallium is consumed in rapidly increasing amounts by high technology applications. The annual primary production of Ga in 2009 of 111t is set to increase twentyfold by 2030 [1,5]. However, Ga is the sixteenth most common element in the Earth's crust (16ppm) and thus is much more common than metals like Cu, Zn, Ag or Cu. Despite of its relative abundance, Ga minerals are very rare and no distinct ore deposits from which gallium could be exploited as major product are known. This is attributed to the close geochemical affinity of Ga to Al resulting in Ga to substitute easily in rock-forming Al silicates (e.g., feldspar, nepheline).

Currently, almost all Ga is extracted as byproduct during beneficiation of bauxite. Ga occurs in bauxite in concentrations of <10-160ppm (Ø50ppm) [4, 5]. Based on the data of bauxite reserves and resources given by the USGS (2010) [5] and Bogatyrev & Zhukov (2009) [2] and under the assumption of an average Ga content of 50ppm, the geologically available Ga quantities in bauxites are estimated as 1.355Mt and between 2.75—3.75Mt Ga, respectively. The majority of bauxite deposits form by intensive chemical weathering of Al-rich lithologies During this process Ga behaves immobile much like Al, and is incorporated into Al-bearing minerals (e.g. gibbsite, kaolinite).

[1] Angerer *et al*. (2009) ISI p 383. [2] Bogatryrev & Zhukov (2009) *Geol Ore Deposit* **51**, 379-396. [3] Meyer *et al*. (2002) *Ore Geol Rev* **20**, 27-54. [4] Mordberg *et al*. (2001) *MinMag* **65**, 81-101. [5] USGS (2010) *Min. Commodity Summaries*.

Crustal growth in the North China Craton at ~2.5 Ga: Evidence from *in situ* zircon U-Pb dating, Hf isotopes and whole-rock geochemistry of the Dengfeng complex

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The Dengfeng complex situated on the southern margin of the North China Craton (NCC) belongs to the southern portion of the Trans-North China Orogen. This late Neoarchean (~2.5 Ga) terrane is important to understand the formation and evolution of NCC during this period. The Dengfeng complex is well exposed in the Junzhao region and comprises two distinct lithologic units: supracrustal assemblage and plutonic rocks. LA-ICPMS magmatic zircon U–Pb dating shows that the complex formed within the range of 2547~2504 Ma. The available Hf isotope data indicate that the majority of ca. 2.5 Ga zircons from the Dengfeng complex give high $\varepsilon_{Hf}(t)$ values close to the initial Hf isotope ratios of the contemporaneous depleted mantle. These indicate that the rocks in the Dengfeng represent juvenile crust. The TTG gneisses in the Dengfeng complex display low Mg# (41-48), MgO (<2 wt%), Cr (6-14 ppm), Ni (9-22 ppm) contents and low Nb/Ta ratio (6-12), which are interpreted to have been produced by the partial melting of a flatly subducted slab. The metadiorites of the Dengfeng complex are typically characterized by high $Mg^{\#}$ (59-69), MgO (3.5-6.6 wt %), Ni (82-130 ppm) and Cr (148-237 ppm) abundances, elevated Sr (1759-1927 ppm) and Ba (1742-2289 ppm) concentrations, and high LREE (La_N=38-487). Such geochemical features are similar to Archean sanukitoids. A two-stage model is applied here to explain the genesis of metadiorites of Dengfeng complex: (1) firstly, the mantle is metasomatized either by melts or by aqueous fluids from a subducted slab; (2) then, sanukitoid magmas were produced by partial melting of the hybridized mantle. Furthermore, the amphibolites of supracrustal rocks have a mixture of MORB- and arc-like geochemical affinities, suggesting the development of a back-arc in the southern part of the NCC at ca. 2.5 Ga. The contemporary late Neoarchean TTGs, sanukitoids and MORB-back arc association may represent a late Neoarchean tectonic mélange, implying for a Neoarchean subduction-accretion process and the modern-style plate tectonics processes probably initiated in the southern NCC by 2.5 Ga.