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Issues of oxygen excess in the crust and upper mantle lithosphere

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Application of a new geochemical buffer, 'CeB' - Ce+4/Ce+3 for zircons, is promising for oxygen fugacity (FO_2) estimation in crust and mantle. Absence of Ce+4 and Eu+2-enriched zircons are typical of the lower lithosphere. Reducing setting dominate in mantle rocks. Subduction adds oxidized substance for lithosphere into deeper mantle (Balashov ea, 2011-2012).
The zircons in upper lithosphere are oxidized. Peridotites minerals show increased H_2O and OH- preserves to 150-160 km at ΔFMQ -1.4 - -0.1 (Babushkina et al, 2009) comparable with CeB 2.2 - 3.9. Increasing oceanic mass in the geological time controls water efflux and oxidation of upper the lithosphere. Oxygen source in crust and upper mantle is the most important, yet outstanding issues in geochemistry of Earth's upper shells.
Oxygen excess in atmosphere correlating with long-term emergence and evolution of Earth's biosphere is an approach reflected in the schemes of cycle- and phase-wise biosphere evolution (Dobretsov et al, 2006; Sorokhtin et al, 2010). The both schemes demonstrate ideas for oxygen evolution of atmosphere, but are not confirmed by geochronology. Applying these outlines an actual picture FO_2 evolution. Precambrian granitoids, detrital zircons and upper mantle lithosphere have similar CeB. The initial data include Australian Hadean and Archaean detrital zircons (Peck et al, 2001), CeB: 27.1 -1.96, and Eu+2/Eu+3: 0.015-0.12 (Balashov, Skublov, 2011).

Greenland tonalities (3813 Ma) and granodiorite (3638 Ma) (Whitehouse, Kamber, 2002) CeB: 34 - 0.5. In oldest crust rocks dominated zircons with generation under high and heterogeneous FO_2. Zircons in younger mantle-crustal rocks of S. American subduction zones (Ballard et al, 2002; Hoskin et al, 2000, etc.) show the same. Upper mantle lithosphere and crust represent continuously interacted with oxygen. If Progressively oxygen increase from Hadean to modern state (Dobretsov ea, 2006; Sorokhtin ea, 2010), contradicts with actual Archaean data. We believe in correlation of biosphere evolution with cyclic mantle and crustal magma activation (Balashov, Glaznev, 2006) reflecting variation of atmospheric volatiles. This corresponds to abrupt sulphur excess due to volcanogenic activation at the peak of the evolution fatally affected the biosphere state. However, volcanogenic epochs are relatively short-term not to contradict the synthesis of oxygen by the biosphere between them. This should ultimately result in significant oxygen heterogeneity in various rock types. Existence of a wide range of Ce+4/Ce+3 in all the surface systems of the Earth, and upper sequence of the mantle lithosphere is related to constant existence of exactly this heterogeneity. Alongside, various types of geological processes in the crust and mantle should have influence, or even define variation stages in the evolution of the biosphere itself. And, this has already been noted. Another constant oxygen source along the whole interval of the Earth's history should be considered solar wind. The continuous flow of the whole range of elements, which portion in the discharge of H, C, O, and other elements to the atmosphere in a proportion close to the composition of 1 (Anders, Grevesse, 1989), may be regarded as a quite competitive option with other sources of oxygen at the Earth's surface.