Mantle-protocore system evolution in the case of heterogenic accretion: Paleomagnetic and isotopic evidences

Y.D. PUSHKAREV[1]* AND S.V. STARCHENKO[2]

[1]Institute of Precambrian Geology and Geochronology, St.-Petersburg, Russia
(*correspondence: ydcanon@rambler.ru)
[2]Institute of Terrestrial Magnetism, Troitsk, Moscow, Russia

The Earth evolution model for the case of heterogeneous accretion is developed as alternative to traditional hypotheses. According to this model the considerable part of the Fe and Ni should initially concentrate in the protocore in which content of the metal component was decreasing to the periphery, but content of chondrite silicates was increasing. The evolution of such 'mantle-protocore' system begins with fast formation of the liquid core geosphere in outer part of the planet. This geosphere expands while moving down, but due to growth of pressure the melting of metal is replaced by its slow erosion on the protocore surfaces. It occurs owing to interaction of metal and such component of the liquid core as S or FeO which lowers temperature of melting. During the protocore erosion its silicate component is liberated and than floats-up through liquid core, producing composite convection which is the main drive of geodynamo. The model calculations show that this process could culminate in early Precambrian, and so the evolution of paleomagnetc records should be observed. At the same time the emerging of the protocore silicate component to the lower mantle should be accompanied by appearance of elements having isotope characteristics of the chondritic material (the high contents of ^{3}He, ^{20}Ne, ^{129}Xe, ^{204}Pb). All these effects most likely confirm the reality of the described scenario of the 'mantle-protocore' system evolution. It is noteworthy that the energy released due to the protocore density differentiation (up to 20 TWT during 4 Ga) could be enough for a long overheat of the core-mantle boundary and for the plum-formation. The analysis of evolution of the geodynamic activity demonstrates that maximum of such endogenous energy generation also corresponds to the early Precambrian.

The interplay between chemical and textural evolution across a shear zone

ANDREW PUTNIS[1]*, HÅKON AUSTRHEIM[2] AND CHRISTINE V. PUTNIS[1]

[1]Institut für Mineralogie, University of Münster, Germany
(*correspondence: putnis@uni-muenster.de)
[2]Physics of Geological Processes, University of Oslo, Norway

The extent to which chemical reactions and mineral replacement reactions due to fluid infiltration influence textural evolution during the formation of shear zones is described from anorthositic granulites in the Lindås Nappe, Bergen Arcs, Norway, where the Grenvillian age granulites (~930 My) are transected by Caledonian age (~420My) eclogite and amphibolite facies shear zones [1, 2]. We focus on the evidence for fluid-induced reactions in the plagioclases which form coarse, clear crystals with composition ~An_{50} in the most pristine anorthositic granulites and become milky as the shear zone is approached, reacting with fluid to form more albitic plagioclase (~An_{25}) with numerous inclusions of clinozoisite, and finally developing an intracrystalline domain structure defined by planar zones of composition ~An_{64} within the plagioclase (~An_{25}) crystals. This apparent 'chemical fragmentation' of the plagioclase single crystals is a precursor to the formation of the much smaller grain size plagioclase crystals within the shear zone. A combination of electron microscopic and analytical techniques is used to describe the interplay between the chemical reactions, the recrystallisation of the plagioclase and the physical deformation forming the shear zone.

[1] Bingen *et al.* (2001) *J. Petrol.* **42**, 355–357. [2] Bingen *et al.* (2004) *Contribs. Min. Pet.* **147**, 671–638.