Geophysical Research Abstracts
Vol. 16, EGU2014-10, 2014
EGU General Assembly 2014

Magmatic systems of large continental igneous province

Evgenii Sharkov

Institute of Geology of Ore Deposits, Petrograpgy, Mineralogy and Geochemistry RAS, Petrology, Moscow, Russian Federation (sharkov@igem.ru, +7-495-951 1587)

Large igneous provinces (LIPs) of the modern type are known from the middle Paleoproterozoic and have a great abundance in the Phanerozoic. The most researches considered their appearance with ascending of the mantle thermochemical superplumes which provided simultaneously eruption of the same type of lavas on the huge territories. Judging on presence among them different subprovinces, formation of concrete magmatic systems were linked with protuberances (secondary plumes) on the superplumes surfaces. We suggest that origin of such plumes was linked with local enrichment of upper part of the superplumes head beneath roofing by fluid components; it led to lowering of the plume material density and initiated ascending of the secondary plumes. As a result, their heads, where partial melting occurred, can reach the level of the upper crust as it follows from absence of lower-crustal rocks among xenoliths in basalts, although mantle xenoliths existed in them.

Important feature of LIPs is presence of two major types of mafic lavas: (1) geochemical-enriched alkali Fe-Ti basalts and picrites, and (2) basalts of normal alkalinity (tholeiites) with different contents of TiO_2. At that the first type of mafites are usually typical for lower parts of LIPs which initially developed as continental rifts, whereas the second type composed the upper part of the traps' cover.

Magmatic systems of the LIPs are subdivided on three levels of different deep: (1) zones of magma generation, (2) areas of transitional magma chambers where large often layered intrusive bodies are formed, and (3) areas on surface where lava eruptions and subvolcanic intrusions occurred. All these levels are linked by feeder dykes.

The least known element of the system is area of magma generation, and, especially, composition of melting substratum. Important information about it is contained in aforementioned mantle xenoliths in alkali basalts and basanites. They practically everywhere are represented by two major series: (1) "green" – spinel peridotite (maily lherzolite) and minor spinel pyroxenite (websterites), and (2) "black" – wehrlite, Al-Ti-augite and hornblende clinopyroxenite, hornblendite, etc., and megacrysts of Al-Ti-augite, kaersutite, ilmenite, sanidine, etc. They often contain vesicles which evidence that their crystallization occurred from fluid-saturated melts. The rocks of this series form veins in peridotite matrix. So, two types of material participated in melting process: moderate-depleted peridotites and geochemical-enriched phase – fluid-saturated melts or high-density fluid. Because the both types of xenoliths are fragments of upper cooled rim of mantle plume head above magma-generation zone, we suggest that they together represent material, which composed plume head and accordingly – the melting substratum. At that the fluid phase exactly provided specific composition of basaltic melts at the initial stages of LIPs development, typical for intraplate settings.

The middle level of magmatic systems is represented by transitional magmatic chambers (now large layered mafic-ultramafic intrusions), where newly-formed magmas were accumulated, undergone by crystallizing differentiation, mixing and crustal contamination. Such transformed in a variable degree magmas continued their way to surface led to general diversity of magmatic rocks, erupted on the surface; contribution of subvolcanic magmatic chambers was, probably, small.

So, systematic study of processes in LIPs' magmatic systems as a whole can help to reveal processes of primary magmas transformation and thereby to determine their initial composition and source material.