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Fe-Ti-V deposits of China and Russia: Tectonic setting, geochemistry and paleomagnetic data

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The origin of very large deposits located inside large igneous provinces is an actively investigated geological problem. The Norilsk Pt-Cu-Ni deposits in the Siberian traps are the most prominent example of co-existence of huge volumes of ores and magmas in space. It is less widely known that this area also hosts a large Fe-Ti-V deposit related to the Dyumtaleysky massif (250± 0.55 Ma). A second example of Fe-Ti–V ores within a volcanic formation is the Panzhihua deposit in the Emeishan magmatic province in southwestern China (Late Permian). Therefore, a question arises regarding the relationships between lavas and intrusions in these provinces and the source of metals for ores. We have used paleomagnetic and geochemical data to address this.

The Siberian province includes OIB and WB basalts located in different tectonic structures. The first ones are concentrated inside the Yenisey-Khatangsky rift zone and comprise four volcanic formations including the most primitive Gudchikhinsky Formation. The Dyumtaleysky massif is the only co-magmatic intrusion with Gudchikhinsky lavas in this area ((Gd/Yb)n =3-4.8 , ƐNd = +4.6 , $^{86}Sr/^{87}Sr$ = 0.703) that contains Fe-Ti-V and PGE-Cu-Ni economic mineralization. Geochemically, the Panzhihua intrusion in the Emeishan province is very similar to the Dyumtaleysky intrusion both in composition and ore occurrences. They both have high-Mg composition and mantle characteristics of initial magmas lacking Ta-Nb negative anomalies, but having Pb and Ti positive anomalies. To understand relationships of the Panzhihua intrusion with lavas, we have studied gabbro and two basalt sections in Emeishan province – Ertan and Binchuan by geochemical methods (XRF and ICP-MS, 83 samples) and paleomagnetic methods (5 sites, in each site 10 to 30 oriented samples were taken). All samples were cut by a non-magnetic saw into cubic specimens and heated to 630°C in at least 12 steps in either MMTD-80 or ASC TD-48 thermal demagnetizers. Also, some specimens were AF demagnetized using a LDA-3A demagnetizer. Measurements of natural remanent magnetization (NRM) were made with JR-6 spinner magnetometers (Lomonosov Moscow State University) and a 2G Enterprises cryogenic magnetometer (Institute of Physics of the Earth).

We can conclude that (1) normal polarity intervals are present in the lower and middle parts of Binchuan section, (2) basalts of the middle and upper parts of Ertan section were erupted, as well as Panzhihua intrusion was formed, during a reversed polarity interval despite the differences in their geochemistry, (3) the Panzhihua intrusion was formed inside a rift zone in the Emeishan province and similar to Dyumtaleysky massif, and (4) these intrusions have very specific and similar REE and isotope geochemistry of rocks and ores due to their tectonic position.