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Petrologic and geochemical study on Paleozoic lamprophyre hosted upper mantle xenoliths and their sulfide inclusions from Tuva (South Siberia, Russia)

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The main aim of this study is to provide detailed petrographic and geochemical features of upper mantle xenoliths and their sulfide inclusions, hosted in ∼440-435 million years old lamprophyre dikes in Tuva Region (South Siberia). The study area is located between southern Siberia and northern Mongolia in Central Asia where one of the oldest members of the Calenodines has been exposed due to the tectonic processes from accretion (late Vendian), through collision (Cambrian) to transform faulting (Ordovician). The lamprophyre melts formed and brought up the xenoliths in the last stage of the tectonic period dominated by transform faulting.
The studied xenoliths are are frequently poikilitic textures orthopyroxene-rich lherzolites, harzburgites, olivine-websterites and orthopyroxenites which suffered a 10-15% partial melting and their rock forming silicates have common mg# (∼0.90). The orthopyroxene-rich character of the studied xenoliths can be the result of interaction between subducted slab-derived SiO2-rich melt and the peridotitic wall rock. The primary sulfide assemblages occur as 1) interstitial phases among mantle silicates or 2) enclosed blebs mostly in orthopyroxenes. Both interstitial and enclosed sulfide inclusions have rounded and irregular shape. The size of interstitial sulfide inclusions ranges between 75-300 mm, whereas the enclosed sulfide blebs are generally smaller (30-175 mm). Based on microscopy, X-ray mapping and SEM study, the primary sulfide inclusions consist of maximum four phases. The primary sulfide minerals are pentlandite, chalcopyrite, pyrite and millerite. Using mass-balance calculation, the bulk composition of the studied sulfide assemblages is mostly plotted in the MSS (monosulfide solid solution) and MSS+LNi,Cu fields (above 1000°C) in the S-Cu-Fe-Ni systems for natural sulfides. The calculated KD3 values, based on the Fe and Ni content of the sulfides and the olivines, suggest equilibrium between the sulfide assemblages and the silicates.