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From mantle to crust: variable origin of clinopyroxene megacrysts from eastern limb of Central European Volcanic Province.

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Clinopyroxene megacrysts carried by alkaline basalts are commonly interpreted as having crystallized from mafic magma that does not always reach the surface. Megacrysts from nine localities of Cenozoic volcanic rocks from E Germany (Lausitz) and SW Poland (Lower Silesia; Central European Volcanic Province) have been studied. They are 1.5 to < 3 cm in size and are either transparent or greenish to brownish in plane polarized light. The transparent megacrysts have spongy rims and contain streaks of minute inclusions of magnetite and sulphide. The coloured megacrysts may contain large magnetite, ilmenite, orthopyroxene and locally apatite inclusions. Their contact with the host lava is sharp with recrystallized rims. All the megacrysts are augite or diopside.
The Mg# varies from 77 to 87 (except for one sample with Mg#=91) in transparent crystals, while in the coloured ones it is generally lower (62-82). Mg# of enstatite inclusions is higher by 0.05 compared to that of coexisting clinopyroxene. The REE patterns of clinopyroxene are usually LREE enriched and convex downward, but the absolute concentrations increase with decreasing Mg#. Coloured megacrysts from two localitites show strong positive Zr-Hf anomalies. These unusual anomalies can be attributed to the presence of apatite inclusions, since the apatite/clino¬pyroxene partition coefficient for Zr and approximately for Hf ranges between 0.066 and 0.132 (Chazot et al.1996). 87Sr/86Sr isotopes vary from 0.703323 to 0.703496 and 143Nd/144Nd reach the values 0.512890 – 0.512904 corresponding to the HIMU reservoir. The Fe3+/Fe ratio varies between 0.313 and 0.365 ($\pm$0.01) in transparent and 0.380-0.445 ($\pm$0.01) in coloured megacrysts, respectively. Calculated crystallization pressures range from 10.5 to 12.3 kbar and 0.6-1.9 kbar in these two types, respectively (Nimis and Ulmer, 1998). The calculated MgO/FeO ratios and trace element compositions for melts in equilibrium with the transparent crystals agree with those of the host lavas. Thus, this group is interpreted as high-pressure precipitates from mafic melt. Calculated melts in equilibrium with the coloured crystals have typically MgO/FeO ratios and trace element contents significantly lower than the host lavas. Therefore, the couloured megacrysts are not cogenetic and must have crystallized from significantly more evolved melts. The composition of melts calculated to be in equilibrium with both apatite and clinopyroxene are similar, indicating cotectic crystallization of these two phases.
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