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Mineral chemical compositions of late Cretaceous volcanic rocks in the Giresun area, NE Turkey: Implications for the crystallization conditions

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This contribution contains phenocryst assemblages and mineral chemical data of late Cretaceous volcanic (LCV) rocks from the south of Görele and Tirebolu areas (Giresun, NE Turkey) in order to investigate their crystallization conditions. The LCV rocks in the study area occur in two different periods (Coniasiyen-Early Santonian and Early-Middle Campanian), which generally consist of alternation of mafic-intermediate (basaltic to andesitic) and felsic rock series (dacitic and rhyolitic) within each period. The basaltic and andesitic rocks in both periods generally exhibit porphyritic to hyalo-microlitic porphyritic texture, and contain phenocrysts of plagioclase and pyroxene, whereas the dacitic and rhyolitic rocks of the volcanic sequence usually show a vitrophyric texture with predominant plagioclase, K-feldspar, quartz and lesser amphibole-biotite phenocrysts. Zoned plagioclase crystals of the mafic and felsic rocks in different volcanic periods are basically different in composition. The compositions of plagioclase in the first-stage mafic rocks range from An_{52} to An_{78} whereas those of plagioclase from the first-stage felsic rocks have lower An content varying from An_{38} to An_{50}. Rim to core profile for the zoned plagioclase of the first-stage mafic rocks show quite abrupt and notable compositional variations whereas that of the first-stage felsic rocks show slight compositional variation, although some of the grains may display reverse zoning. On the other hand, although no zoned plagioclase phenocryst observed in the second-stage mafic rocks, the compositions of microlitic plagioclase show wide range of compositional variation (An_{45-80}). The compositions of zoned plagioclase in the second-stage felsic rocks are more calcic (An_{65-81}) than those of the first-stage felsic rocks, and their rim to core profile display considerable oscillatory zoning. The compositions of pyroxenes in the first- and second-stage mafic-intermediate rocks vary over a wide range from diopside and augite to pigeonite ($Wo_{27-49}En_{35-48}Fs_{9-30}$ with Mg#=58-83 for the first-stage and $Wo_{3-43}En_{43-69}Fs_{13-39}$ with Mg#=56-78 for the second-stage). Although most of the pyroxene phenocrysts in both stages show no zoning, some are chemically heterogeneous and exhibit zoning as variations in parameters, such as Mg# [Mg/(Mg+Fe^{2+})], which are not systematic from core to rim. This may be related to changing physicochemical conditions through magma ascent and/or to the local effects of disequilibrium crystallization. The investigated amphiboles and biotites of the volcanic sequence are particularly present in the second-stage felsic rocks. The amphibole crystals are considered to be members of the calcic amphibole with magnesio-hornblende to actinolite with their Mg# ranging between 45 and 66. Biotites have relatively high Mg# (50-76). All compositional variations for the zoned plagioclase and clinopyroxene phenocrysts imply that complete equilibrium has not been reached during crystallization of the mafic and felsic magmas. Moreover, abrupt compositional variations in some plagioclases require rapid changes in the conditions of crystallization (P, T, fO_2, etc.). However, slight variations in oscillatory zoning are best interpreted as a result of local effects of disequilibrium crystallization.

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