CRYSTALLIZATION CONDITIONS OF THE TOYGAR VOLCANICS (ALAŞEHİR-WESTERN ANATOLIA / TURKEY)

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Introduction: Turkey is located in one of the most actively deforming regions in the world. The tectonic evolution of Turkey is very complex due to the continental collision between the Arabian and Eurasian plates during Mesozoic and Tertiary. The convergence between the Arabian and Eurasian plates started in the Late Cretaceous and continued until the late Middle Miocene to Late Pliocene-Quaternary [1]. As a result of this convergence, the eastern part of Anatolia has undergone crustal thickening, while western Anatolia has experienced several geologic events such as widespread volcanism and extensional faulting causing graben formation [2,3]. The West Anatolian volcanism started in Oligocene times (~30 Ma) and continued during Pliocene to present times. Volcanic products are mainly large andesitic-basaltic composition lava flows with subordinate pyroclastics, various ignimbrite units. Volcanic rocks show calc-alkaline to alkaline affinity [4-6]

Petrography: Toygar volcanics are exposed a limited area in Alaşehir Graben of Western Turkey. They exhibit generally massive and/or flowing structures in the field. Fresh surfaces of volcanics are characteristically dark grey to greenish grey in color and chiefly display porphyro-aphanitic texture in hand specimens. Plagioclase, amphibole and biotite are easily seen as pheocrystal phases. Mafic ellipsoidal and/or angular shaped xenolitic enclaves are found in volcanics.

Toygar volcanics display hypohyaline porphryric, vitrophyric and fluidal textures under the microscope. They are mainly composed of plagioclase, amphibole, biotite, pyroxene and Fe–Ti oxides (magnetite, hematite) phenocrysts. A significant amount of weathering is also observed in euhedral mineral phases.

The volcanic rocks have medium-K calcalkaline nature and peraluminous character. Volcanics are characterized by trachy-andesite and basaltic andesite/andesite in the Nb/Y vs. $Zr/TiO_2 \times 0.0001$ diagram.

Mineral Chemistry: Plagioclase is the dominant phenocryst. Plagioclase compositions of Toygar volcanics vary from $Ab_{12.2–59.8}An_{20.1–87.6}Or_{0.2–61.7}$.The plagioclases plot mostly on the labradorite and bytownite regions on the albite–orthoclase–anorthite (K–Na–Ca–Al silicate) triangular diagram. Amphiboles in the Toygar Volcanics contains $(Ca+Na) \geq 1.34$, $Na < 0.67$ and $Ca > 1.34$. Amphiboles occur as both subhedral and euhedral grains. Using the nomenclature of amphiboles of [7] based on the Si content versus $Mg/(Mg+Fe^{+2})$ ratio indicate that they are in the composition of Mg-rich amphiboles and plots on ferroan pargasitic hornblend region. The biotites are "ferrous biotites" and ocur as elongated crystals [8]. Microprobe analyses of the pyroxenes were determined on the core of each crystal and plot on the clinoenstatite area of the enstatite-wollastonite-ferrosillite triangular diagram with compositions $Wo_{1.31–3.64}\ En_{45.17–74.81}\ Fs_{22.81–53.08}$ [9].

According to the biotite, amphibole and pyroxene mineral chemistry, pressure and temperature conditions calculated for Toygar Volcanics. Geotermometry calculations from biotite minerals based on [10] suggest the temperature between 705–763°C. We have also calculated 797–962ºC and 1.39–3.58 kbar P–T conditions with using hornblende geothermobarometry [11]. According to the emplacement pressures have been estimated 5.26–12.56 km emplacement depth with using a continental crustal density.

All data supports the idea that Toygar Volcanics were formed from subalkaline magma is highly affected by crustal contamination processes during ascent through the crust. Furthermore, plagioclase, hornblende, pyroxene, iron-titanium oxide dominated fractionation is active during the crystallization of the parental magma which is emplaced at 5.26–12.56 km depth.

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