Petrography and geochemistry characteristics of the calk-alkaline Tertiary (?) tuffs in the Gumushane area, NE Turkey

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The study area is in the southern zone of the eastern Pontides, which is characterised by Liassic, Upper Cretaceous and Eocene volcanism [1]. Eocene volcanism consists of acidic, notr and basic volcanic and pyroclastic rocks in Gumushane and surrounding area [2]. In this study, mineralogical, petrographical and geochemical properties of the Gumushane region tuffs were investigated. These rocks are consisting of andesite, dacite, lapilli, vitric and silicification tuffs. Tuffs contain plagioclase (An_{28-50}), amphibole, glass shards, lesser pyroxene and K-feldspar, opaque oxides, secondary clay, sericite, calcite, chlorite, and devitrified glass. It is excessively weathering and silicification, and cut by dolerite.

Tuffs have a composition of contents 52-67% SiO_2, 0.55-0.74% TiO_2, 14-18% Al_2O_3, 0,5-6% FeOt, 0.2-2.2% MgO, 1.5-2.9% Na_2O and 1.5-6% K_2O. Geochemically, these rocks change from andesite to dacite in composition and exhibit medium-high K calcalkaline characteristics. In variation diagrams show two different trends. Dacitic tuff is characterized high K_2O, Na_2O and Al_2O_3 and low CaO, Fe_2O_3, MgO and P_2O_5, but andesitic tuff is of inverse value. In addition, generally Na_2O, Fe_2O_3, Al_2O_3, CaO and MgO decrease whereas Zr, Ba, Rb, Th, U and Nb increase with increasing SiO_2. Rare earth element patterns pronounced Eu anomalies indicating plagioclase fractionation. All samples are characterised by significant flattening of REE patterns from Dy to Lu relative to the LREE. $(Lu/La)_N$ value is change from 3.3 to 7.7.

The investigated tuffs differ from the Eocene volcanics in the southern zone by their field, petrographical and geochemical characteristics. Probably these tuffs may be related to post Eocene volcanism.

References

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Critical crater diameter and the impact response of asteroids

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Asteroid surface morphologies are expressions of the seismic properties of their interiors. They allow us to measure, to first order, how an asteroid responds to collisions and other high energy events through a quick examination of its largest craters.

The critical crater diameter D_{crit} is defined as the minimum crater diameter on an asteroid whose formation disrupts, through distal shock and seismic effects, all previous craters $\leq D_{crit}$. This threshold is computed by applying crater scaling relations and peak particle velocity attenuation relations. If the largest distinct crater observed on an asteroid is typically at or near this threshold size, it follows from this analysis that small asteroids (e.g. 25143 Itokawa) can have no sizable craters, relative to their diameter, while large asteroids (e.g. 253 Mathilde) are likely to have hemisphere-spanning craters.

Because D_{crit} can approach or even exceed the size of the target, the largest asteroids like Mathilde are likely to be saturated with hemisphere-spanning craters – up until the size that the asteroid is a geologically active and gravitationally relaxing planet. This is because craters smaller than D_{crit}, however gigantic they might appear, do not broadcast globally.

Stress wave velocities on known asteroids, as parameterized by the model, are found to decay with the ~1.3 power of distance for most asteroids (circles plot the largest identified crater on each asteroid). This is much less attenuative than strong shocks. This is expected, because disturbances capable or destroying crater rims on asteroids are of very low particle velocity, and thus require stress waves lower in amplitude than typical lunar regolith cohesion. Models for asteroid catastrophic disruption, which rely upon stronger attenuation or upon hydrocodes tuned to energetic blast events, consequently over-estimate particle velocity attenuation and over-estimate the threshold for catastrophic disruption Q^*_D.