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Late Miocene Goderdzi Volcanic Formation, Lesser Caucasus, Georgia: Evidences of the Presence of a Caldera

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The Late Miocene Goderdzi formation in the Lesser Caucasus forms a volcanic highland of andesitic-dacitic composition, which occupies more than 4500 km2 in Georgia. Its total thickness reaches 1100 m [1]. In the Mtkvari river canyon which cuts through the formation, thick (40-50 m) ignimbrite deposits crop out at 35 km distance. Isotopic Nd parameter of the ignimbrites varies between +2 – +4, and 87Sr/88Sr parameter - between 0,7034 – 0.7045. These parameters point to the mantle origins of these ignimbrites. U-Pb dating of zircons show that the Goderdzi formation ignimbrites were erupted about 7.5 Ma – in the Late Miocene [2].
In Mtkvari river canyon, near Vardzia cave complex pyroclastic fallout deposits (250 m) are overlain by above-mentioned thick (60 m) ignimbrite deposits (Vardzia horizon), which, in turn are capped by heterolithic breccias. Sizes of individual breccia fragments exceed 1 meter in diameter. These breccias record caldera collapse event, when blocks of destroyed volcano vent were emplaced on top of pyroclastic density currents (ignimbrites). Near Chachkari village, breccias are covered by 2.5-3 m thick volcanic ash layers - typical for silicic calderas. Interestingly, similar layer of ash can be found on the opposite side of Mtkvari river, on the Javakheti highland.
Presumably, all explosive eruptions that erupt more than 5 km3 of volcanic material produce a caldera. The sequence, described above, was noticed recently; it is obviously very similar to so-called caldera-forming eruption (CFE) sequence that is characteristic for large collapse calderas and it records different stages of caldera forming events [3]. Large overall thickness and peculiarities of sequence of pyroclastics indicate that at least some part of the Goderdzi formation was formed by strong caldera forming explosive eruption. The caldera itself has not yet been identified due to intense deformation, erosion and concealment of volcanics.
Observed thickness of ignimbrites in Mtkvari river canyon increases from south to north, whereas changes in color and degree of welding, point to the temperature decrease; thus, they are indicative of the movement direction of pyroclastic density currents and the ignimbrites can be assumed to be extracaldera formations.
Recognizing CFE sequence and analyzing the spatial-temporal distribution of volcanic products of the Goderdzi formation are important steps for identifying the Late Miocene caldera. Calderas in their turn, can provide us with useful information about magma evolution, major tectonic and magmatic events, and they can be significant source of several types of ore deposits.

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