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Pleistocene explosive activity of the Gölcük volcano, Isparta Angle, Turkey

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The Gölcük volcano is built up on superposed limestone and flysch thrust sheets and eroded Pliocene volcanic formations (dykes, domes, lahar etc). The Isparta volcanism belongs to the post-collisional alkali potassic-ultrapotassic magmatism that occurs between Afyon and Antalya from North to South. In the so-called Isparta Angle the magmatism is contemporaneous with an extensional tectonic process operative from late Miocene to Pliocene and Quaternary. Previous $^{40}K/^{40}Ar$ dating was performed on lavas and showed that the potassic-ultrapotassic magmatism occurred between 4.7 to 4 Ma. However, the recent and probably Quaternary activity of Gölcük volcano has never been dated precisely and its age remains controversial. The new volcanic cycle that built up the Gölcük volcano is depicted by three main volcanic formations: (1) more than 200m-thick pyroclastic flow deposits occasionally separated by paleosoils corresponding to major initial plinian eruptions, (2) tephriphonolite lava flows and dome which extrude through the caldera and presently located only at the rim of the present crater, (3) building of the last tuff-ring with successive phreatoplinian eruptions of a maar-type volcano, this event ends with trachytic dome extrusion process within the maar crater. Two dating methods were used. The classic $^{40}K/^{40}Ar$ dating on mesostasis was performed on lavas of tephriphonolites and trachytic domes. This method is not suited for tephras which form 90% of the eruptive products of Gölcük. The tephras have been dated using the single-crystal $^{40}Ar/^{39}Ar$ method. Extraction and isotopic analyses of gas have been done by laser-melting of single alkali feldspar crystals (about 30 crystals per sample of porphyritic pumice pyroclasts of pyroclastic

flow and pumice fall deposits) using a high-sensitive noble-gas mass -spectrometer (MM 5400). Age-population of laser-melted crystals are very homogeneous or very heterogeneous depending of mixing between juvenile crystals (dating the event) and reworked old crystals. When the age-population is relatively continuous, the probability maximum for the crystal population is assumed to give the best age estimate of the volcanic event. Bimodal age-populations illustrate the mixing between juvenile pyroclasts and remobilised old and cold pumice lithoclasts during the blast and the pyroclastic rush. The older crystals from lithoclast remain enough cold to prevent their degassing and loss of radiogenic Ar. The $^{40}Ar/^{39}Ar$ dating method on single crystal is very useful to permit resolution of the juvenile crystals and the age of the eruption from the older contaminating crystals. The entire activity of Gölcük volcano took place during Pleistocene and was disconnected from the older (Pliocene) volcanism. It can be considered as a new volcanic period starting with a major explosive regional event at 206.1 $\pm$ 9.8 ka and lasting about 50.000a after with at least 6 explosive episodes relatively spaced in time. A second event consisting of lava dome, flows and dykes: this lava episode occurred between 115 $\pm$ 3 ka to 62 $\pm$ 2 ka with probably some tephra deposits at the bottom of the tuff-ring. The ensuing tuff-ring formed from 72.7 $\pm$ 4.7 ka to 24 $\pm$ 2 ka, the volcano is a maar, the phreatoplinian eruptions have almost entirely destroyed the previous lava flows and dome, this last cycle ending by trachytic dome extrusions. There are several volcanic crisis with relative long time of quiescence as illustrated by the two domes extrusions separated by about 30 ka. The volcanic history of Gölcük seems presently interrupted since 24 ka $\pm$ 2 ka. The periodicity of eruptive processes of Gölcük volcano appears to be long and major crisis are probably separated by several thousands years. Presently, the volcanic history of this explosive volcano appears to be not closed. The major valleys actually opened on the northern flank of the volcano are potential channelways for future pyroclastic flows. New pyroclastic surges will also sweep out this flank leading directly to Isparta area.