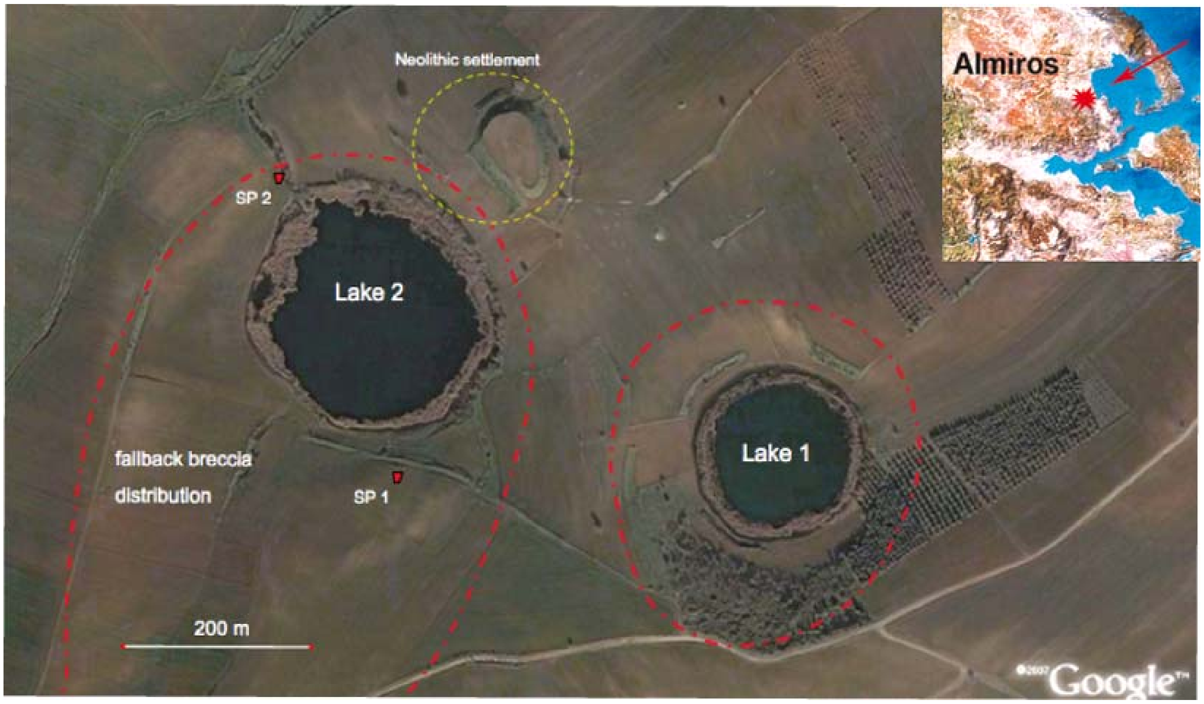
Mineralogical and Geophysical Investigations on the Twin-Meteorite Impact Craters in Thessaly (Central Greece)



SUMMARY

This is the first time that impact meteorite craters have been recognized in Greece. Two circular permanent lakes of 150 and 250 m in diameter and both 6 to 8 m depth, occur 250 m apart from each other in the agricultural fields SW of the town of Almyros (Thessaly). This picturesque site is known as the prehistoric Magoula Zerelia settlement, which was occupied from the Middle Neolithic period until Late Bronze Age. According to an older reference "the temple of *Athena Itonis* is situated in one of the two lakes and only visible when the lake falls dry" that only happened in 1980 after an earthquake. The formation of the lakes can be assumed on their fresh morphological character as Holocene age and may be bracketed between approximately 12 500 and 8000 years BP.

The working hypothesis of their origin due to meteorite impact was based on the finding a considerable amount of angular to rounded clasts and polygenic breccias in the sandy-silty clay of their shores as well as in their suspicious halos during reconnaissance investigations. All these rocks did not resemble either any of the surrounding rock formations or any volcanic material. The petrographic, mineralogical and chemical evidence of the collected clasts and polygenic breccias lead to the interpretation of the "carbonatitic" material as molten and quenched "impact fallback breccias and carbonatitic tectites" due high-temperature to shock-metamorphic meteoritic impact. According to the size of the crater lakes the dimensions of the meteorite, which might have split into two fragments, could have been about 10-30 m before reaching the surface.

Therefore, the major goal of the project was to find remnants of the meteorite, to investigate the underground structure of the lakes by geophysical methods in order to verify the hypothesis of their impact crater shapes and to find mineralogical evidence of high-temperature and high-pressures shock metamorphism.

Detailed petrographic and mineralogical studies (optical microscopy, scanning electron microscopy, Raman spectroscopy, X-ray diffraction) on a large number of samples from millimeter to decimeter rock size confirmed the previous results (spinifex carbonatites with feathery spinifex and spherulitic textures, glassy tektites, deformed and fragmented quartz crystals) and thus evidence for shock-metamorphism and melting. The most convincing evidence is the finding of partial melted zircon, for which temperatures greater than 1400°–1800°C are required, which do not occur in metamorphic and magmatic process in the Earth's crust and uppermost mantle.

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