THE GUARDA STRUCTURE (PORTUGAL): IMPACT STRUCTURE OR NOT? MICROSTRUCTURAL STUDIES OF QUARTZ, ZIRCON AND MONAZITE.

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Introduction: The Guarda Structure is a circular structure located in the Iberian Massif, just northeast of the city of Guarda, Portugal. The structure has a diameter of ~35km and is formed in Variscan granitoids. Monteiro [1] suggested that the Guarda Structure is a deeply eroded complex multi-ring impact crater. He argued that the circular topography and the hydrographic pattern in combination with planar features in quartz crystals are evidence for an impact crater centered at 40˚ 37'N and 7˚ 6'W.

Methods and samples: We collected field data and rock samples in the Guarda Structure and did detailed optical microscopy and SEM-analyses (backscattered electron (BSE) and cathodoluminescence (CL) imaging) on potential shock microstructures in quartz, zircon and monazite, to check whether the Guarda Structure is an impact structure or not. The microstructures in the samples from the Guarda Structure are compared to shocked quartz, zircon and monazite from two confirmed impact structures; the Ries Crater, Germany and the Vredefort Dome, South Africa. The usability of optically visible shock microstructures in zircon and monazite was studied as well.

Results and discussion: The lithology of the Guarda Structure is dominated by two types of granitoids; in the center non-phenocrytic granitoid and in the outer rings the lithology is dominated by granitoids with up to 80% feldspatic phenocrysts. Impact rocks, such as shatter cones, pseudotachyllites and suevitic or lithic breccias were not found. The circular topography and drainage pattern in the Guarda Structure may be formed due to lithology differences that are exaggerated by erosion.

In quartz grains from the Guarda Structure, only tectonic deformation lamellae and no shock microstructures are observed. Monazites and zircons from the Guarda Structure show no planar microstructures, while in Vredefort samples, multiple sets of planar microstructures and granular texture are observed in both monazite and zircon. Comparison of the location of the Vredefort samples with the shock pressure distribution by [2] indicates that planar microstructures in zircon and monazite may start to form at shock pressures from 10 GPa, which is lower than reported previously for zircon by for example [3].

Conclusions: The lack of both field and microstructural impact evidence makes it highly unlikely that the Guarda Structure is an eroded impact crater.

Shock microstructures in zircon and monazite may form at lower shock pressures (from 10 GPa) than reported previously.

References: [1] Monteiro J. F. 1991. Abstract #1456, 22nd Lunar & Planetary Science Conference, pp. 915-916. [2] Gibson R. G. and Reimold W. U. 2005. *Geological Society of America Special Paper* 384:329-249. [3] Wittmann et al. 2006. *Meteoritics & Planetary Science* 41:433-454.