SHOCK-INDUCED PHASE TRANSFORMATIONS OF SiO_2 POLYMORPHS IN MARTIAN METEORITES. U.W. Bläß[1] and F. Langenhorst[2]. [1]Institut für Geowissenschaften, Friedrich-Schiller-Universität Jena, Germany. E-mail: Ulrich. Blaess@uni-jena.de. [2]Bayerisches Geoinstitut, Universität Bayreuth, Germany.

Introduction: Phase transformations occurring during severe meteoritic impacts on planetary bodies are crucial indicators for estimating maximum shock pressures and temperatures. Their identification is not only essential for a detailed understanding of the shock history and origin of these meteorites, but also for deciphering their pre-shock petrology and magmatic evolution. Most shock-induced transformations of silicates comprise either amorphisation processes, such as the formation of maskelynite, or crystallisation of high-pressure polymorphs from shock melt veins or pockets [1]. However, high-pressure polymorphs of SiO_2 may represent an exception, since the recent discovery of several tens of microns large crystals that transformed to Seifertite (α-PbO_2 structured SiO_2) point to an unknown fast solid state transformation process or appreciable higher shock conditions [2,3]. In order to constrain the formation conditions of Seifertite during shock metamorphism, we investigated its occurrence in Shergotty, Zagami (29 and 31 GPa [4]) and Dhofar 378, which experienced extremely high shock conditions of 55-75 GPa [5].

Samples and methods: Thin sections of Shergotty, Zagami and Dhofar 378 were examined by optical microscopy and electron microprobe, and after careful ion thinning by transmission electron microscopy using low electron doses to avoid a rapid amorphisation of irradiation sensitive samples.

Results: In Shergotty and Zagami, silica polymorphs could only be identified in the mesostasis, occurring together with maskelynite and traces of either tranquillityite or iron sulfides. Silica phases are typically a few microns large and show characteristic sets of amorphous lamellae, but no further microstructural features, whereas accessories show high densities of shock related defects. Electron diffraction pattern of crystalline SiO_2 fragments are consistent with Seifertite. In contrast, no post-stishovite phases have been identified in Dhofar 378.

Discussion: The defect microstructure of accessory phases in Shergotty and Zagami indicate that Seifertite bearing areas are not remolten during the impact event and therefore Seifertite must have been formed by a solid state process. We assume, that both meteorites did not experienced significantly higher shock pressures than estimated earlier by [4], which denotes a transformation occurring at pressures far below the equilibrium pressure of Seifertite of around 80 GPa. Higher shock pressures would cause severe melting of such areas as observed in Dhofar 378, where former plagioclase crystals are completely remolten as obvious from the formation of bubbles and recrystallised needles occurring in the rim of such areas. In Dhofar 378, high post-shock temperatures have probably prohibited the recovery of potentially formed post-stishovite phases.

References: [1] Langenhorst F. and Poirier J. P. 2000, *Earth and Planetary Science Letters* 184:37–55. [2] Sharp T. G. et al. 1999. *Science* 284:1511–1513. [3] El Goresy A. et al. 2004. *Journal of Physics and chemistry of solids* 65:1597–1608. [4] Stöffler D. 1986. *Geochimica et Cosmochimica Acta*, 50:889–903. [5] Ikeda Y. et al. 2006. *Antarctic Meteorite Research*, 19:20-44.