K-FELDSPAR AND BIOTITE AS SHOCK INDICATOR MINERALS FROM BOSUMTWI IMPACT CRATER. ***Sz. Nagy[1], A. Gucsik[2], Sz. Bérczi[3], K. Ninagawa[4], H. Nishido[5], Á. Kereszturi[6], H. Hargitai[3], T. Okumura[5],*** [1]Eötvös University, Dept. Petrology and Geochemistry, H-1117 Budapest, Pázmány Péter sétány 1/c, Hungary (**ringwoodit@yahoo.com**); [2]Max Planck Institute for Chemistry, Dept. of Geochemistry, Becherweg 27, D-55128, Mainz, Germany; [3]Eötvös University, Institute of Physics, Dept. G. Physics, Cosmic Materials Space R. Group, H-1117 Budapest, Hungary; [4]Department of Applied Physics, Okayama University of Science, 1-1 Ridai-cho, Okayama, 700-0005, Japan; [5]Research Institute of Natural Sciences, Okayama University of Science, 1-1 Ridai-cho, Okayama, 700-0005, Japan; [6]Collegium Budapest, Institute for Advanced Study, H-1014 Budapest, Szentháromság tér 2. Hungary.

Introduction: We have investigated granitic rock fragments from the Bosumtwi Lake impact structure by optical microscope, and Scanning Electron Microscope (SEM). The SEM images were taken in BS-mode. The K-Feldspar and Biotite minerals show weak and moderate shock stage effects, especially occurrence of Planar Fractures (PFs) and Planar Deformation Features (PDFs). The sample was derived about 5 km away from the crater center according to the shock-induced Planar Deformation Features (PDFs) in Quartz.

Bosumtwi Lake impact structure: The Bosumtwi impact crater in Ghana is one of the best-preserved young (1.1 Ma) complex impact structures known on Earth, displaced a pronounced rim, and is almost completely filled by Lake Bosumtwi, a hydrologically closed basin [1]. It is the source crater of the Ivory Coast tektites. The structure was excavated in 2.2-2.1 Gyr. old metasediments and metavolcanics of the Birimian Supergroup [1]. The coordinate of the crater is 6° 30. 3′N, 1° 24. 5′W. A forfold zonation has been proposed for this crater structure, comprising the 8.5 km-wide crater interior, a ca. 1.5 km-wide rim zone, an about 4 km-wide annular depression around the crater rim, and another, slightly elevated, ring feature at ca. 10 km from the center [2].

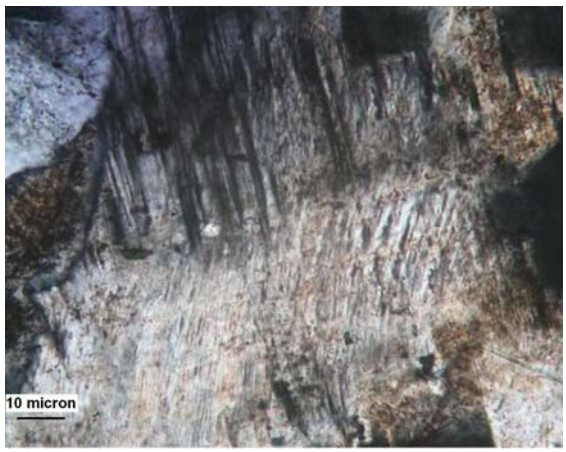

Fig. 1. Highly shocked microcline feldspar from Bosumtwi impact crater, Ghana. The lower part of the image contains PDFs, and in this area the original twins disappear.

The shocked rock characteristics: The rock, that we investigated derived 5 km from the crater center. The sample is a granitic rock type with pink color, because of the feldspars. The feldspars are microcline and orthoclase and less plagioclase. The rock contains abundant biotite fragment, that show kink-banding effect. Quartz fragments are abundant in the rock showing PDFs with two sets. The minor minerals are rutile, titanite, ilmenite, and less zircon. In some cases, the feldspars might contain PDFs between the polysynthetic twins (Fig. 1). and in unique cases the polysynthetic twins disappear, and the whole fragment contains PDFs (Fig. 2).

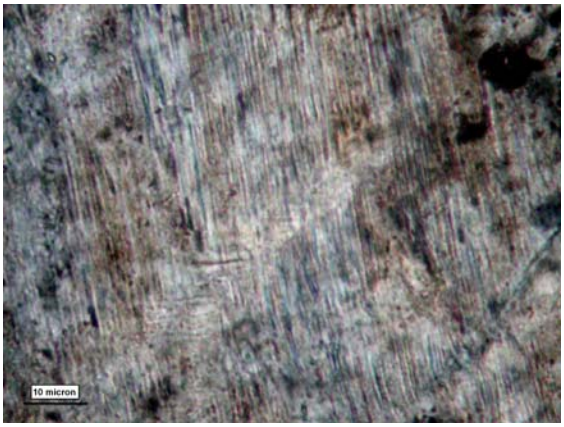

Fig. 2. A 90X60 micron highly magnified area, from the lower part of Fig. 1.

Gucsik et al. [3] proposed that in less scales the shock wave propagation not to sphere symmetric [3], because of variations in the physical properties of target rocks. This is a good agreemnt with the Fig. 1. observation, that this theory may be acceptable.

The feldspar characteristics: The feldspar shows numerous shock effect. The most abundant features are PFs and PDFs. In the BSE image, the PFs have ordering rational crystallographic orientation. Two sets are discernible such as NW-SE and N-S directions. In general, the edges of the PFs are ending in wedge shape (Fig. 3). The PFs are discontinous on the border of the other phase (Fig. 3). The surface of this feldspar show slightly kink band effect too. The upper left side of the image

exhibits shear faults, that shearing the PFs. The PFs are maximum 30 μm long, and 2 μm wide. The spacing between two PFs sets is maximum 5μm (Fig. 3).

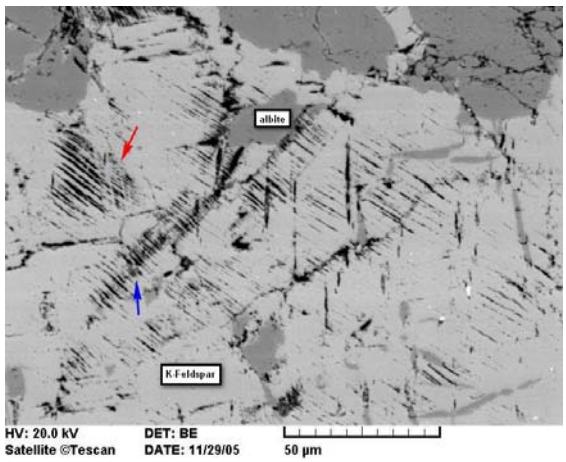

Fig. 3. SEM-BE image about the K-Feldspar from the Bosumtwi impact structure. The red arrow shows the shearing effect, the blue arrow indicates the slightly kink band features. (Mag. 1300X).

The feldspar have neither completelly melting features nor partially melting effects.

The biotite characteristics: Biotite in this sample shows euhedral shapes exhibiting clevages as well-identified features. The grain sizes are variable, but typically 300 μm long. In some cases, the grain orientation perpendicular to the basal plane (Fig. 4). In this orientation, we can identify the „hitting figure" from which we can determine the type of the Glimmer. For this method it is necessery to know the grain plane orientations. The kink band effect is more abundant in the biotite compared to feldspar. The „hitting figure" and its cracks are not straight showing irregular fracture characters (i.e.,slightly curved).

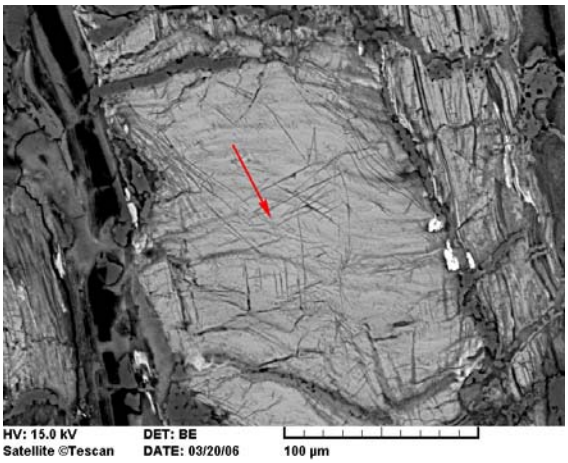

Fig. 4. „Hitting Figure" in biotite from the Bosumtwi impact structure. The grain orientation is perpendicular to the basal plane.

In whichever orientation the PFs have denser presence than in distinctive orientation. In this cases the PFs are close to each other (Fig. 5). The biotite is similar to the feldspar, not showing any melting effects.

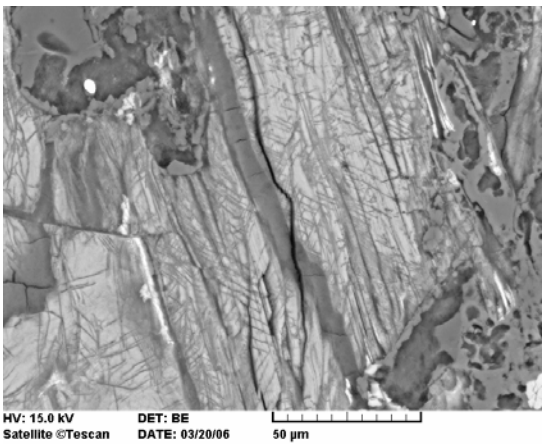

Fig. 5. Whichever oriented biotite grain with abundant PFs.

Conclusion: According to the shock effects in feldspar, biotite and quartz, shock stages of this sample show between weakly and moderately shocked parts. For feldspar and biodtite have typicaly the PFs and kink banding shock effects, and shearing cracks, while for the quartz the PDFs, and in some cases begining amorphisation. On the bases of our observation the shock pressure in this sample not have reached the 25GPa. The temperature was maximum 300°C, and just in some area reached over the temperature 300°C. According to these physical properties our sample rock lied during the shock processes in the middle zone of the shocked area.

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References: [1] Koeberl, et al. (2007) Meteoritics and Planetary Science 42, 483-511. [2] Jones, W.B. et al. (1981) GSA Bull., 92, 342-349. [3] A. Gucsik (2008) *submitted to Meteoritics Planet. Sci.*