IMPACT GLASSES OF THE LAKE BOSUMTWI IMPACT STRUCTURE, GHANA: IVORY COAST TEKTITES, MICROTEKTITES, FALLBACK PARTICLES AND SUEVITE GLASS – SIMILARITES AND DIFFERENCES. L. Adolph and A. Deutsch. Institut f. Planetologie, WWU Münster, Wilhelm-Klemm-Str. 10, D-48149 Muenster, Germany (Leonie.Adolph@uni-muenster.de).

Introduction: The Bosumtwi impact structure in Ghana, Western Africa, originated 1.07 Ma ago. The ~10.5 km-large Bosumtwi crater (Ø) is excellently preserved and source of one of the four known tektite strewn fields [1], i.e., the IVC (Ivory Coast strewn field) and the associated microtektites found in off-shore drill cores [2, 3].

Bosumtwi lake sediments and impactites were target of the ICDP Bosumtwi Core Drilling Project (BCDP). Two cores recovered impactites (BCDP-7A in the annual moat, and BCDP-8A at flank of the central uplift). These cores mainly comprise only weakly shocked meta-greywackes, and phyllites as well as various impact breccias [4, 5]. The lowermost part of sediment core LB05 includes the transition between impactites and post-impact lake sediments in a ~10 cm thick zone (117A) that contains glassy fallback particles. The sedimentary matrix of this zone is a mixture of clast of feldspar, quartz, subordinate of chlorite, graphite, mica and ore minerals [6].

Impact melt products – different origin, identical chemistry or vice versa? The various glass types related to the Bosumtwi impact event, namely the dar brownish IVC, microtektites, fallback particles, and melt glass in suevites (samples BOT) may have formed during yet unkown different stages in the cratering processes at different temperatures, and probably from different source lithologies. The goal of the study is to reveal this not yet constrained formation conditions.

In this study we will extent the existing data base [7] of optical characterisation, major elements, Sr-Nd isotope ratios, and some trace elements by multi-element, in-situ trace element using the LA-ICP-MS technique. We will compare the data for Bosumtwi melt lithologies with data for various tektites (bediasites, australites and moldavites), and using geochemical fingerprinting as tool, with selected target rocks at Bosumtwi [4, 5].

Fallback particles, IVC tektites and microtektites. So far glassy fallback particles are only known from the 0.7 Ma old Zhamanshin crater, Kazakhstan, and the Sowjet nuclear test site at Nowaja Semlja. The Bosumtwi sample 117A contains about 80 fallback light yellowish to brownish colored particles. They are spherules, dumbbells and splitters of aerodynamically shaped bodies, ranging in size from 100 to 400 µm (Fig. 1). Their surfaces show pits coated with clay minerals of unkown. Under the microscope, the glass is colorless, free of inclusions and schlieren. Bubbles and vacuoles, however, are present, their abundance increases towards the rim. Two IVC tektites with Ø ~2 cm, and eleven microtektites, sized between 20 and 200 µm show similar characteristics, yet display in addition rarely schlieren.

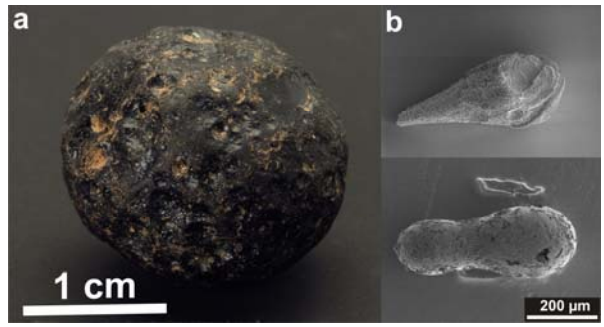

Fig. 1. (a) Ivory Coast Tektite with dissolution pits, and (b) SE images of two glassy fallback particles with typically elongated shapes (teardrop, dumbbell).

Results: *Major elements.* Each measured particle has a very homogenous compoisition, yet significant differences exist between samples of one group as well as between the four groups (Fig. 2). The fallback particles, show the following range in chemical composition (wt%): SiO_2 - 62.7 to 66.3 , Al_2O_3 - 15.3 to 17.5, CaO - 2.5 to 3.2 , and MgO - 2.6 to 5.1. The IVCt tektites have a MgO content of 3.3 to 4.2 wt% and low CaO contents of 1.15 to 1.32 wt%. The IVC microtektites have SiO_2 contents between 55 and 67 wt%, low Cao yet in part high Mgo contents. As illustrated in correlation diagrams of Figure 2, individual glass shards in the suevites have very different compoistions, indicating a large variation in precoursor lithologies. Compared to the microtektites, the fallback particles have a high Na_2O content.

Rare Earth Element (REE) patterns. The four differnt glassy lithologies have very similar REE distribution patterns (Fig. 3) but slightly diffent abundances. The patterns are in good accordance with that for the major precursor lithologies, phyllite-slates and meta-graywackes through lower REE contents [9, 10].

Outlook: The major element and REE composition of the glass lithologies is in fairly good accordance with that of target rocks with intermediate SiO_2 content. Moreover, the chemical composition of fallback particles, IVC tektites, and microtektites is rather similar, yet variations in Ca and Mg exist that may reflect heterogeneous carbonate distribution in the pre-

cursor material. Results of the current LA-ICP-MS studies will help to understand to origin of the fallback particles, the IVC tektites and microtektites, and of the glass shards in the suevites.

References: [1] Koeberl C. et al. (2007) *MAPS* 42, 483-511. [2] Glass B.P. (1969) *GCA* 33, 1135-1147. [3] Glass B.P. et al. (2004) *GCA* 61, 3971-4006. [4] Coney L. et al. (2007) *MAPS* 42, 569-589. [5] Deutsch A. et al. (2007) *MAPS* 42, 635–654. [6] Ferrière L. et al. (2007) *MAPS* 42, 689-708. [7] Luetke S. et al. (2006) *IODP/ICDP-Kolloquium*, Abstract Vol 87. [8] Deutsch A. & Langenhorst F. (2006) *IODP/ICDP-Kolloquium*, Abstract Vol 87. [9] Koeberl C. et al. (2007) *MAPS* 42, 709-729. [10] Koeberl C. et al. (1997). *GCA* 61, 1745-1772. [11] Rudnick R.L. & Gao S. (2004). *In: Treatise on Geochem. (e.d. H.D. Holland) Elsevier,* 1-56.

Acknowledgments: The drilling at Bosumtwi was supported by ICDP, NSF, Austrian FWF, Canadian NSERC, and the Austrian Academy of Science. We appreciate support by DFG grant De 401/19. We appreciate skillful technical assistance by U. Heitmann. as well as advice by J. Berndt (WWU) and B. Glass (U Delaware) who also provided the microtektites.

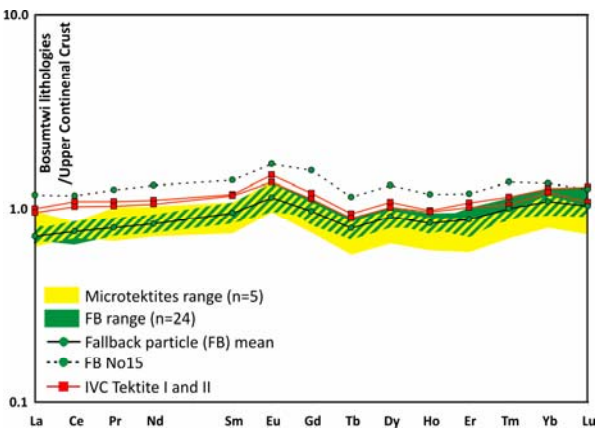

Fig. 3. Average REE distribution patterns normalized to the average upper continental crust [11] for two IVC tektites (■), microtektites (■) and fallback particles (●). The complete overlap of the data reflects the high degree of homogenity for these impact melt lithologies. *Analytical technique:* Element2 LA-ICP-MS (5Hz, 8–9 J/cm^2; Inst. f. Mineralogie, WWU), Si as internal and NIST612 as external standard. For tektites, 3 spots Ø 60 µm, and for microtektites and fallback particles 1 spot Ø 35 µm per sample were measured.

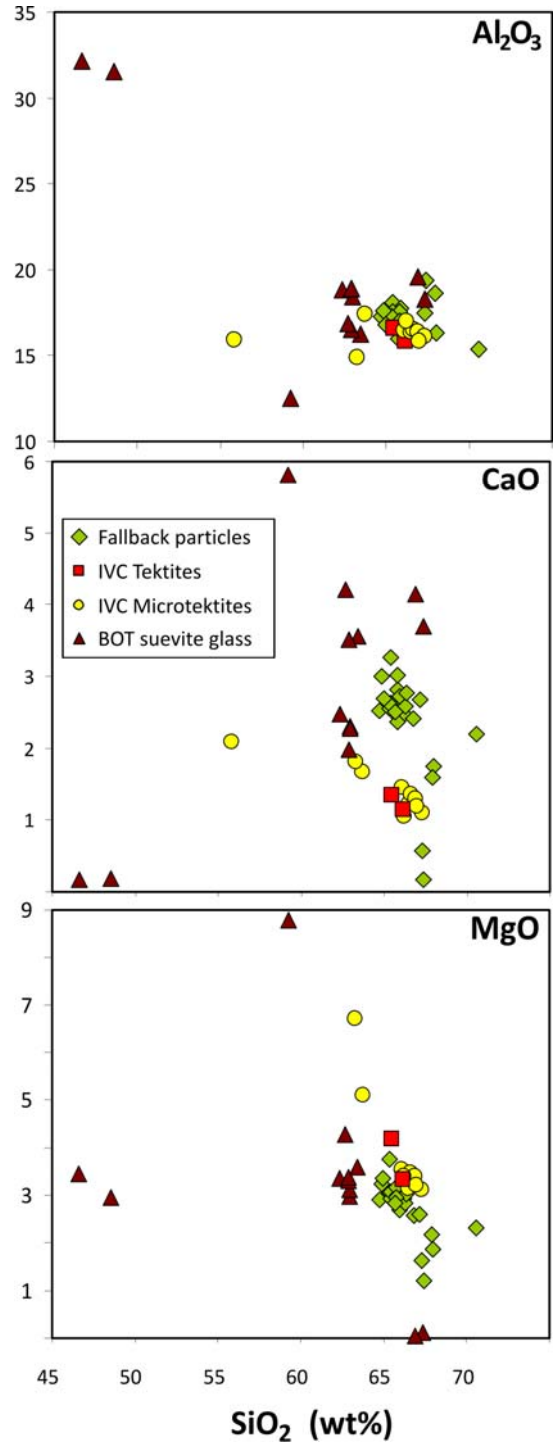

Fig. 2. Al_2O_3, CaO, MgO vs. SiO_2 in the three glassy materials related to the Bosumtwi impact event: Fallback particles (♦), IVC tektites (■), microtektites (●). All melt products are related to BOT, a suevitic glass (▲). *Analytical technique:* JEOL JXA 8900M Superprobe (Inst. f. Mineralogie, WWU), 15 kV acceleration voltage, 5 nA sample current, and 5 µm defoc. beam, with a moldavite as internal standard.