

Platinum group elements in the ICDP cores from the Bosumtwi crater, Ghana S. Goderis^{1,2}, R. Tagle¹, Ph. Claeys¹, R. T. Schmitt³, J. Erzinger⁴, ¹Dept. of Geology, Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium, ²Dept. of Geology and Soil Science, Ghent University, Krijgslaan 281, 9000 Ghent, Belgium, ³Institute of Mineralogy, Natural History Museum, Berlin, 10099 Berlin, Germany ⁴GeoForschungsZentrum Potsdam, 14473 Potsdam, Germany.

Introduction: The Bosumtwi crater has a diameter of 10.5 km and is located in the center of Ghana in West Africa (6° 30' N and 1° 25' W). Its age is 1.05 Ma and it forms a well preserved impact structure with a well defined rim. Its center is occupied by the closed basin of Lake Bosumtwi. The target rock is essentially composed of Proterozoic (2.1 to 2.2 Ga) units of the Birimian Supergroup that consists of lower greenschist facies metasediments, schists, phyllites, graywackes, quartzite and a minor granitic component. The Bosumtwi crater is the probable source of the Ivory Coast tektites and microtektites recovered from drillings in the East Tropical Atlantic [1]. The Bosumtwi crater was drilled in the Summer and Fall of 2004 by the *International Scientific Drilling Project (ICDP)* [2]. Two cored holes (LBO7A and LBO7B) located in the crater center (Fig. 1) penetrated through the lake sediments into impactite lithologies.

The goal of this study was to identify the type of projectile responsible for the formation of the Bosumtwi crater based on PGE elemental ratios [3].

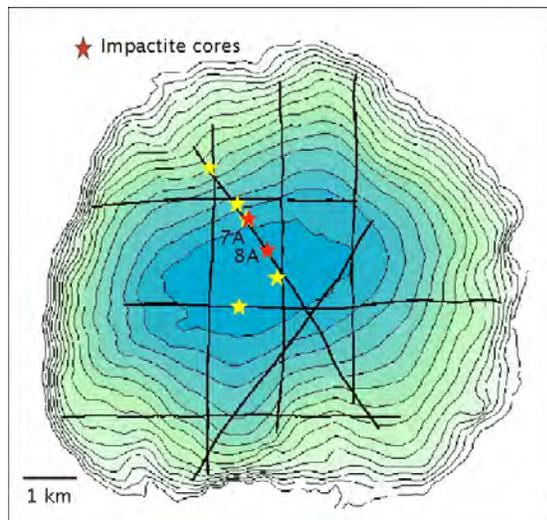


Fig.1: Location, on existing seismic profiles, of holes LBO7A and LBO8A drilled by the ICDP within the depression and on the flank of the buried central uplift of the Bosumtwi crater, black lines represent existing seismic profiles (image modified after [2]).

Samples and Method: The impactite lithologies of cores LBO7A and LBO8A (total depth of 540 and 450 m, respectively) were samples for geochemical investigations, in particular platinum group elements (PGE)

analyses. Twelve samples were selected from LBO8A and thirteen from LBO7A. Based on macroscopic examination, the samples were taken in sections where the amount of impact melt appeared high. In the laboratory, microscopic examination was carried out to further select 13 samples (5 in LBO8A and 8 in LBO7A) to be analyzed for PGE. The selected samples contained a relatively high proportion of melt fragments compared to metasedimentary clasts. Approximately 10 g of powdered sample was analyzed by ICP-MS after preconcentration using nickel sulfide fire assay, according to the procedure described in [3;4]. Major and trace elements were determined on the same samples by ICP-MS and/or XRF.

Results: The PGE concentrations measured on the Bosumtwi impactites from the LBO7A and LBO8A cores are given in Table 1.

Depth (m)	Ir ng/g	Ru ng/g	Pt ng/g	Rh ng/g	Pd ng/g	Au ng/g
7A						
335.4	0.27	0.37	1.92	0.16	1.70	0.70
356.5	0.14	0.21	7.21	0.15	1.33	1.66
371.3	0.33	0.27	2.28	0.21	3.46	1.31
389.6	0.12	<0.1	0.51	0.04	0.47	0.33
404.4	0.42	0.80	5.73	0.35	5.00	3.20
408.5	0.43	0.11	1.52	0.14	1.06	0.65
412.2	0.64	0.76	4.87	0.24	1.43	1.42
468.9	0.18	0.12	1.68	0.09	1.04	0.99
Ave.	0.32	0.38	3.22	0.17	1.94	1.28
Stdev.	0.18	0.29	2.39	0.10	1.52	0.89
8A						
235.6	0.12	<0.1	0.85	0.07	1.35	0.94
258.7	0.18	0.14	1.20	0.08	1.36	0.67
399.9	0.08	<0.1	0.80	0.04	0.55	0.82
435.8	0.16	0.28	2.02	0.13	1.99	1.79
442.4	0.10	0.11	0.61	0.03	0.63	0.46
Ave.	0.13	0.18	1.10	0.07	1.18	0.94
Stdev.	0.04	0.09	0.56	0.04	0.60	0.51

Table 1: PGE and Au concentration data of the Bosumtwi cores LBO7A and LBO8A. The detection limits in ng/g are: Ir = 0.055, Ru = 0.098, Pt = 0.067, Rh = 0.022, Pd = 0.194, Au = 0.13, Os was not measured [3].

The results agree with recently published PGE data obtained on suevite samples collected from the crater rim and surrounding areas [5]. Suevite deposits occur to the north and southwest of the crater. The agreement is particularly good with three suevite samples, also analyzed by NiS-ICP-MS (see Table 5 in [5]), confirming the ability of this method for the determination of PGEs in impact melt rocks.

The PGE concentrations are slightly elevated compared to crustal value. The CI chondrite normalized PGE patterns of Bosumtwi samples are presented in Figure 2a. The patterns differ from the flat pattern expected for chondritic values (Fig. 2b). The presence of an extraterrestrial chondritic component in the Bosumtwi impactite cannot be confirmed.

The PGE patterns are much more similar to the crustal values shown by the red line in Fig. 2b. This indicates that the Bosumtwi target lithologies contributed significantly to the PGE composition of the impactites. The indigenous PGE concentrations in a variety of target lithologies (schist, metasediment, graywacke, granite) are high compared to normal crustal values and overlap with the concentrations obtained on suevites [5]. As noted in [5], this is not surprising since the Bosumtwi crater is situated in a region known for its gold-sulfide mineralizations.

Conclusion: PGE concentrations and patterns do not provide any evidence of a meteoritic component in the impactites from the LBO7A and LBO8A cores drilled in the center of the Bosumtwi crater. The type of projectile responsible for the crater formation cannot be identified. This result agrees with the conclusion of [5] based on the analyses of suevites from the crater rim. The meteoritic signature, if present, is either very low (<0.1 wt% of nominal CI) and/or concealed by the elevated PGE contribution from the target rocks.

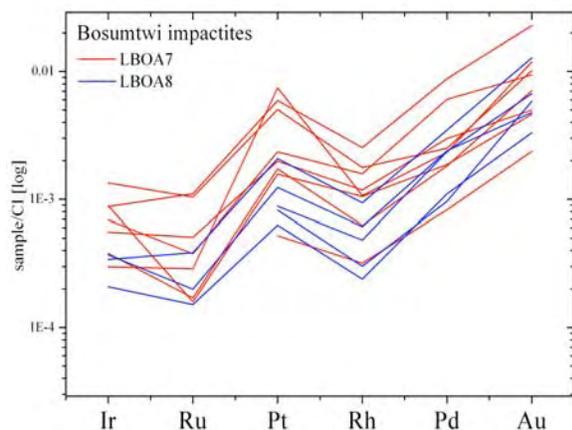


Fig. 2a: CI normalized PGE and Au concentrations of impactites from the Bosumtwi drill cores LBOA7 and LBOA8. The PGEs are plotted from left to right in order of decreasing condensation temperature.

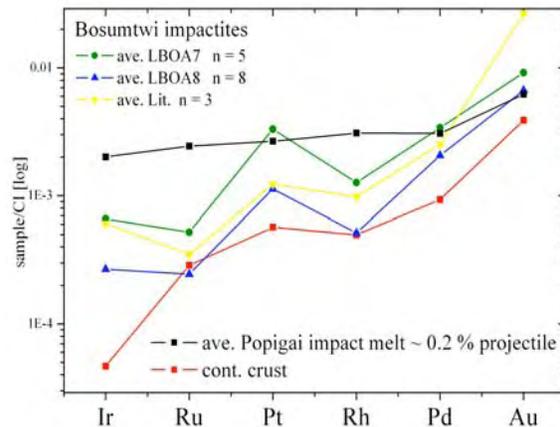


Fig. 2b: CI normalized PGE and Au concentrations (average values) of impactites from the Bosumtwi drill cores LBOA7 and LBOA8, compared to average values of the three suevite samples originating from the crater rim (also NiS-ICP-MS analyses from [5]). For comparison, the Popigai impact melt (black line) displays a rather flat chondritic pattern [3]. The composition of the average continental crust is shown in red.

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