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Zircon U-Pb and Hf-Nd isotopic constraints on the genesis of granites from the vicinity of Bosumtwi crater

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The well preserved Bosumtwi crater (Ghana), 10.5 km in diameter and 1.07 Myr old (e.g., Koeberl and Reimold 2005), was excavated in rocks of the Early Proterozoic Birimian Supergroup. These rocks were deposited 2.1-2.15 Gyr ago in a volcanic arc environment and were metamorphosed to greenschist facies during the Eburnean tectono-thermal event (e.g., Jones et al. 1981, Feybesse et al. 2006). The Birimian Supergroup mainly consists of two contemporary units: volcanic belts and sedimentary basins aligned in multiple parallel features. Additionally, numerous granitoid intrusions were emplaced within the Birimian Supergroup (Wright et al. 1985). Two main types of granitoid intrusions are recognized in Ghana: belt granitoids and basin granitoids (Leube et al. 1990). Both types can be distinguished according to petrology, chemistry, and age.

Whereas previous studies of target rocks from the Bosumtwi crater focused on metasedimentary rocks (e.g., Karikari et al. 2007), in this study we investigate felsic intrusive bodies. This work will also provide more data on the geological evolution of the Kumasi basin and Ashanti belt regions in Ghana.

We analyzed thirteen samples for their major- and trace element compositions, as well as their U-Pb, Lu-Hf, and Sm-Nd systematics. Twelve samples come from three different felsic intrusive bodies. Two intrusions are located to the north of the crater, previously described as basin-type granitoids, whereas one intrusion was classified as belt-type granite (Koeberl and Reimold 2005). One sample represents a mafic (diabase) dyke.

Analyses were performed using optical microscopy, XRF, and INAA at the University of Vienna, as well as by MC-ICPMS at the University of Bonn. Additional zircon U–Pb ages were obtained with VG Sector-54 multicollector TIMS at the Massachusetts Institute of Technology.

Zircon ages for samples from four different intrusive bodies vary within a narrow range between 2091.96 $\pm$ 7 Ma and 2097.70 $\pm$ 7 Ma. A whole-rock 147Sm-143Nd regression line, defined by six samples coming from all sampled bodies, correlates to an age of 2048$\pm$63 Ma, in accordance with the U-Pb data for zircons. Notably, a sample from a mafic intrusion plots also on the regression line. Whole-rock 176Lu-176Hf data define a regression line yielding no meaningful geological age, possibly due to inherited old zircons from the source. Our first results suggest that, despite previous research (Koeberl and Reimold 2005), all studied intrusions genetically belong to the basin-type intrusions. All intrusions share common geochemical and petrologic properties, and were emplaced at approximately the same time.

References

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