

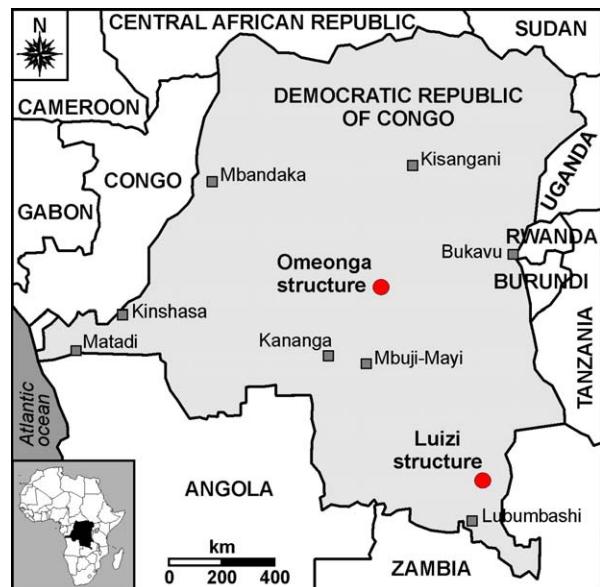
## RECENT WORK AND CONFIRMATION OF CONGOLESE METEORITE IMPACT STRUCTURE(S).

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**Introduction:** With growing access to satellite imagery, the number of circular structures presently considered to be of suspected impact origin has dramatically increased (see, e.g., [1]). However, confirmation of a new impact structure must be supported by unambiguous evidence of shock-deformations and/or traces of extraterrestrial material (e.g., [2]).

Two such large circular structures occur in the Democratic Republic of Congo (DRC; Fig. 1), namely the Luizi and the Omeonga structures, but because this region of Earth is difficult to access, only remote sensing data was available until recently. In the present contribution, the results of geological field investigations conducted at both sites are presented. These field observations, together with petrographic investigations, allow us to better understand the origin of these two structures. Additional objectives of this work include the validation of remote sensing interpretations, the study of the influence of these structures on the local geology, and also the drainage patterns associated with the structures.

The aim of the present contribution is also to show that significant scientific work can be conducted in DRC, although despite improvement in the security environment during recent years, some parts of the DRC remain unstable.



**Fig. 1:** Location map of the Luizi and Omeonga structures in the Democratic Republic of Congo.

**Luizi structure:** The Luizi structure (Fig. 2), centered at 10°10'13.5"S and 28°00'27.0"E, on the Kund-

lungu Plateau of the Katanga province, lies in the southeastern corner of the DRC. The structure, with a rim diameter of ~17 km, exhibits, from the periphery to the center, a rim elevated up to ~300–350 m above the crater interior, an annular depression, an intermediate ring with a diameter of ~5.2 km, and a ~2 km wide circular central ring around a central depression [3].



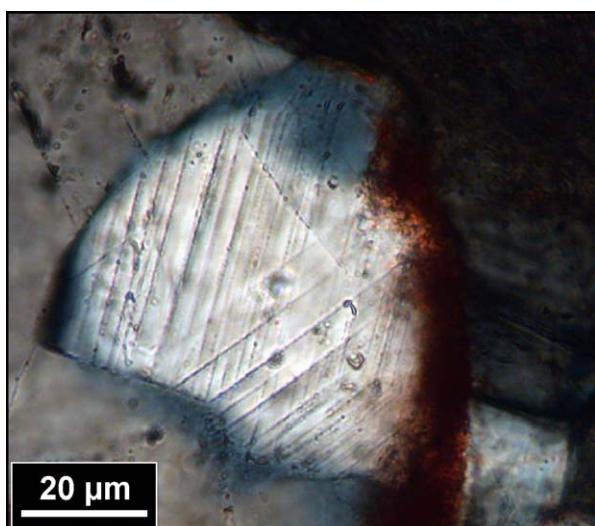
**Fig. 2:** Landsat image of the Luizi structure.

Following the first and only field geological report on the Luizi structure that was published in 1919 [4], P. K. Kaseti and myself have conducted a field campaign there in July 2010. Altogether, more than 30 outcrops were studied. Exposed rocks consist of tabular massive arkosic sandstone beds (cm- to dm-thick), with intercalated laminated argillaceous sandstones. We were able to immediately confirm the impact origin in the field due to the presence of *in-situ* well-developed shatter cones in sandstone (up to 40 cm in length). They occur at several locations within the central part of the structure, and up to 1.6 km from the center. Monomict lithic breccia dikes, up to ~2 m thick, and cross-cutting sandstone beds, occur up to ~3 km from the center of the structure. Other monomict lithic breccia occurrences (i.e., *in-situ* brecciated target rocks) were noted locally, as well as more or less abundant pervasive fractures occurring up to ~6 km from the center of the structure.

Petrographic observations of the collected samples have resulted in the detection of microscopic shock-metamorphic features in minerals, including abundant PDFs in quartz grains (up to five PDF sets per grain were observed under the universal stage; Fig. 3) and rare shock deformations in perthitic alkali feldspar.

Our findings have allowed us to demonstrate that the Luizi structure, in which unambiguous shock de-

formation features occur, is a complex meteorite impact crater, the first one to be recognized in Central Africa [3].



**Fig. 3:** Photomicrograph (crossed polars) of quartz grains with two PDF sets with  $\omega\{10\bar{1}3\}$ -equivalent orientations in shatter cones from the Luizi structure.

**Omeonga structure:** The Omeonga structure, centered at  $3^{\circ}37'50"S, 24^{\circ}31'00"E$ , is located in the center of the DRC, in the Sankuru District (Kasai-Oriental Province), about 1,000 km east of Kinshasa and only 10 km south-south-east from the territorial capital of Katako-Kombe. It is named after the village of Omeonga located within the structure, at ~7 km south-west from its center.

The structure is easily recognizable from satellite images (Fig. 4) because of its almost perfect annular ring filled with water. The Lonya river defines the limits of a circular feature of ~38 km in diameter.

In satellite images the structure exhibits the expected morphology of an eroded complex impact crater, with a rim (here emphasized by the Lonya river) and a central uplifted zone. The drainage is characterized by a dendritic radial pattern with rivers flowing from the central part of the structure to the annular ring.

The Omeonga structure was added to the list of possible/probable meteorite impact structures in 2005-2006 [1], but had been suspected as a possible impact structure for many years before that. Recently, an Italian team claimed that they were the first to detect this structure in 2009-2010, and discussed its hypervelocity origin based only on remote sensing data (e.g., [5]). However, remote sensing techniques alone cannot reliably verify or invalidate claims of impact origin.

Field investigations were conducted by P. K. Kasetti and myself in July 2011; most of the structure was investigated. However, because of the very poor nature of outcrops, only limited geological data was recorded. Altogether, 32 samples were collected: mainly sandstones (white, gray, yellow, red, pink, and brown in color), lateritic conglomerates (with pebble-size quartz clasts), clays, limestones, and sands, likely of Pleistocene and Pliocene age. Neither shatter cones nor breccias were found. Thus, based only on our field investigations, it is not possible to either confirm or disprove the meteorite impact origin of the Omeonga structure. However, a volcanic or a kimberlitic origin can certainly be excluded based on the nature of the collected rocks and because of the extremely large size of the structure.

Petrographic thin sections from all the collected samples are in preparation. Thus, first microscopic observations will be presented at the meeting.

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**References:** [1] Rajmon D. (2009). Impact database 2010.1. (<http://impacts.rajmon.cz>). [2] French B.M. and Koeberl C. (2010) *Earth-Science Reviews*, 98, 123–170. [3] Ferrière L. et al. (2011) *Geology*, 39, 851–854. [4] Grosse E. (1919) *Neues Jahrb. Mineral. Geol. Palaeontol.*, 42, 272–419. [5] Monegato et al. (2010) *LPS XXXXI*, Abstract #1533.



**Fig. 4:** Google Earth view of the Omeonga structure. Note the deep green forests that extend along rivers and the gray-pinkish spots that correspond to grass savanna.