

POTENTIAL-FIELD MEASUREMENTS ON THE VELINGARA CANDIDATE IMPACT STRUCTURE (SENEGAL)

Y. Quesnel¹, P. Rochette¹, D. Baratoux^{2,3}, C.A.B. Niang⁴, M. Fall⁴, and N. L. Kouame³, S. Wade⁵, M. Kaire⁶, G. Faye⁵, ¹Aix-Marseille Université, CNRS, IRD, INRAE, CEREGE, Aix-en-Provence, France (quesnel@cerege.fr), ²Géosciences Environnement Toulouse, CNRS, Institut de Recherche pour le Développement (IRD) & Université de Toulouse, 31400 Toulouse, France, ³Université Félix Houphouët-Boigny, UFR Sciences de la Terre et des Ressources Minières (STRM), Abidjan, Côte d'Ivoire, ⁴Département de Géologie et Institut Fondamental d'Afrique Noire Cheikh Anta Diop, Université Cheikh Anta Diop, 10700 Dakar, Senegal, ⁵Laboratoire de télédétection Appliquée, Institut des Sciences de la Terre, Université Cheikh Anta Diop, Dakar, Sénégal, ⁶Association Sénégalaise pour la Promotion de l'Astronomie

Introduction: The Velingara depression, located in the southern part of Senegal, consists in a near-circular basin of about 40 km of diameter, bordered by a subtle rim up to only 60 m above the altitude of the basin. The central part of the depression is occupied by rice fields, marshes and a lake. Eocene and post-Eocene deposits of sediments fill the depression, while lateritic cuirass is exposed at the rim. There are almost no outcrops of basement rocks below the recent sediments, except in an irrigation channel where quartz veins and mica schists have been reported [1]. Using satellite imagery and a compilation of other various old data (collected samples, shallow drillings, local resistivity surveys, regional gravity data), previous studies [1, 2] have postulated that Velingara corresponds to a buried complex impact crater with a central uplift. The used data are difficult to interpret and sometimes not available. Some PDFs seem to have been observed on samples, but again, reports are hard to confirm.

The Bouguer gravity data stored by the Bureau Gravimétrique International (BGI) do not really show a significant anomaly unveiling a circular structure, and indicate a WNW-ESE regional gradient linked to the presence of the thick sedimentary Casamance basin to the west, and to the crystalline basement rocks of Guinea-Bissau to the south. No airborne magnetic data were acquired in the area (only outside, in Casamance and SE of Senegal). We did not have access to cited electrical resistivity local cross-sections [2], reporting shallow resistive blocks which may indicate uplifted basement rocks.

Methology: In the framework of an international program between France and Senegal, a new geophysical survey has been performed in March 2022, with the aim to identify the best place for a possible drilling in the future. Ground gravity and magnetic field measurements were acquired at about 2 km spacing (sometimes 500 m in the central part, sometimes more than 2 km outside) within the depression and crossing the ring. A Scintrex CG-5 gravimeter was used for gravity measurements, accompanied by an Emlid Reachview RS-2 GPS mobile antenna. Another RS-2 GPS antenna was used as GPS reference base station during each day of prospection. Post-Processing Kinematic (PPK) treatment was then applied to these GPS data to get circa 4 cm resolution on the vertical positioning of each gravity measurements. All classical corrections were then performed to the raw gravity measurements to calculate the complete Bouguer gravity anomaly using 2400 kg m^{-3} as density of regional rocks. Magnetic field measurements have been acquired using a MMPOS Overhauser magnetometer. The anomaly was computed after subtraction of the ambient regional field measured in parallel by a Geometrics G856 base station. The Total Magnetic Intensity anomaly was then reduced to the pole.

Preliminary results: The Bouguer gravity residual signal clearly shows a circa 15 mGal negative circular anomaly centered nearby the lake, with a diameter of about 10 km. Outside this negative signal, we do not see any other circular signals. It means that the topographical ring is much larger than the gravity anomaly. The magnetic field anomaly map reveals significant anomalies of about 50 nT, which may argue in favor of the presence of shallow buried crystalline rocks.

Discussion: these results confirm the presence of a low density formation in the center of the Velingara depression. They could be brecciated / fractured formations of crystalline (magnetic) basement, or post impact sediments. Modeling of the anomalies will be performed, in parallel to the drilling in the central part of the depression. Collected samples will be also searched for shock indicators.

References:

- [1] Wade, S., Master, S., Rudant, J.P., Lichtenegger, J., and Barbieri, M. (2006) Analyse par Télédétection et pétrographie de la structure circulaire de Vélingara (Casamance, Sénégal). *PHOTO-INTERPRETATION* N° 2006/1
- [2] Master, S., Diallo, D. P., Kande, S., and Wade, S. (1999) *LPS XXX*, Abstract #1926.