
Is the Makgadikgadi Basin (Botswana) related to the southwestern propagation of the East African Rift System?

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Résumé

The commonly assumed idea that continental rifts propagate through time is still strongly debated, mostly because the modalities of such a propagation are poorly understood. In Africa, the southwestern branch of the East African Rift System (EARS) is largely assumed to propagate through the Southern-African plateaus reaching the Okavango Graben, considered as its present-day terminus. Southeast of the graben, the Makgadikgadi Basin forms wide flat areas, having hosted paleolakes and covered with evaporitic deposits. The Makgadikgadi Basin displays a set of faults known as the Makgadikgadi Rift Zone (MRZ). Their orientation and proximity to the Okavango Graben faults suggest potential tectonic relations between these structures. However, the role of the MRZ in the regional geodynamics remains unclear. Based on fieldwork and topographic analysis (GPS and DEMs), we conducted a geomorphologic study of fault scarps, linear dunes and paleo-shorelines within the Makgadikgadi Basin. It allows us to better constrain the fault pattern of the MRZ, showing a tectonic continuity with the Okavango Graben and northern segments of the EARS. Offsets of linear dunes indicate a normal-dip kinematics of faults, pointing to a NW-SE extensional opening. The morphological analysis of major paleo-shorelines in the Makgadikgadi Basin shows the presence of beach ridges cross-cutting fault-scarps. The studied ridges rise at a constant elevation, proving that they have undergone very little deformation since their deposit. The major lake development phase that corresponds to their formation thus post-dated the main tectonic activity of the MRZ. The few ages available in the literature date those undeformed shorelines to the late Pleistocene, suggesting that the MRZ faults remained poorly active at least since the beginning of the Holocene. The present-day tectonic activity in the Makgadikgadi Basin is therefore much slower than in the Okavango Graben. Based on these results, we propose a propagation model for the southwestern branch of the EARS, where rift deformation migrates from northeast to southwest forming NE-SW oriented parallel grabens. As propagation evolves, the deformation localizes along specific segments, such as the Okavango Graben, connected between them by transfer zones. The adjacent structures such as the MRZ are abandoned.

Mots-Clés: Geomorphology, Rift, Active tectonics, Lacustrine beach ridges

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