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Africa's megafans and their tectonic habitat

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Megafans are large fluvial sediment bodies, fan-shaped in planform, defined here as >80 km long. Africa's megafans were mapped both for comprehensive geomorphic description and as a method of mapping the largest probable fluvial sediment bodies (in unconfined settings, most unexamined, versus confined, floodplain sediment bodies) by remote sensing means. Our criteria were: a river crossing a topographic margin from upland to lowland; a smooth, low angle coniform plain (the river entering the plain at/near the apex, roughness measured from SRTM data); a length dimension of >80 km and maximum width >40 km; and a radial drainage pattern. To obviate possible confusion with deltas, we excluded fanlike features that reach the coastline. Visible and especially IR imagery was used to identify the features.

We identified 94 megafans. Distribution patterns markedly followed the basin-and-swell topography [1] that characterizes Africa's modern landscapes. Although clearly visible, most of the features identified are inactive due to incision by the source river into fan surfaces.

Two tectonic habitats control the location of megafans. (i) Swell flanks. Megafans are apexed at the topographic margin of most of Africa's swells, extending into those basins large enough to accommodate them. Such megafans are often clustered in groups of 3-7, as e.g., on the west side of the Hoggar Swell (Algeria), on north and south flanks of the Tibesti Swell (Libya-Chad borderlands), on the east flank of Africa's largest East African Swell in Kenya, and those on the east and south sides of Angola's Bié Swell (western Zambia and northern Namibia). Clusters of possible fans, not meeting all criteria, lie on the Congo Basin margin of the Mayombe Swell, and on the coast-facing margin of the Namibia Swell. Two of the largest lie in W/NW Africa, the Teghahart megafan of southern Algeria (378 km, Hoggar Swell), and the Wadi Albalata megafan in western Egypt (340 km, Uweinat Swell). In southern Africa the two largest are the Cubango (320 km) on the southern margin of Angola's Bié Swell, and the Limpopo (230 km) that is apexed at the South Africa-Mozambican border (the largest of a small group of megafans located in Africa's coastal lowlands). (ii) Rifts. (ii.a) Rift basins. About 26 megafans have developed within rifts or over rift depressions. Although most rifts are too narrow to provide a transverse dimension large enough to form megafans >80 km long, the main group developed lies in the wide Muglad Rift of South Sudan (n=14). Three megafans cluster in the Okavango Rift (NW Botswana and NE Namibia). Other rift-related groups are three large megafans SE of Lake Chad (S Chad) and one unusual megafan, the Salamat feature (Central African Republic), that is oriented parallel with the rift axis, and is consequently one of the longest in Africa (465 km). Interestingly this megafan occupies a rift depression atop the Nile-Congo Swell. (ii.b) Rift exterior slopes. Shoulders of the East African Rift (EAR) display several megafans produced by rivers aligned away from the shoulders that lead into wide basins, especially in Kenya and South Sudan.

Africa's largest is the Nile megafan (476 km) that has built the vast Sudd wetland (SE South Sudan). An explanation for its size may be its and location at the meeting point of three tectonic zones, the Ethiopian Swell margin, exterior margin of the western arm of the EAR, and the Muglad rift. Discharge of the River Nile, the largest in the region, has allowed the Nile megafan to outcompete neighboring megafans for space.

Reference:

[1] Burke K and Gunnell Y (2008) Geol. Soc. America, Memoir 201. 66 pp.

