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Modes, tempo and spatial variability of Cenozoic cratonic denudation: morphoclimatic constraints from West Africa

Anicet Beauvais (1) and Dominique Chardon (2)

(1) CEREGE, Aix Marseille Université, IRD, CNRS, Collège de France, BP 80 - 13545 Aix-en-Provence Cedex 4 France (beauvais@cerege.fr / 33 4 42971595), (2) Université de Toulouse, UPS (OMP), LMTG, 14 Avenue Edouard Belin, 31400 Toulouse, France (dominique.chardon@lmtg.obs-mip.fr)

After the onset of Gondwana break-up in the Early Mesozoic, the emerged part of the African plate underwent long Greenhouse effect climatic periods and epeirogeny. The last Greenhouse effect period in the Early Cenozoic and the alternation of wet and dry climatic periods since the Eocene enhanced episodes of rock chemical weathering and laterite production, forming bauxites and ferricretes, interrupted by drier periods of dominantly mechanical denudation, shaping glacis [1]. In Sub-Saharan West Africa, this evolution resulted in pulsate and essentially climatically-forced denudation that has shaped an ubiquitous sequence of five stepped lateritic paleosurfaces that synchronously developed over Cenozoic times. The modes, timing and spatial variability of continental denudation of the region are investigated by combining geomorphologic and geochronological data sets. The geomorphologic data set comprises the altitudinal distribution of the lateritic paleosurfaces relicts and their differential elevation from 42 locations in Sub-Saharan West Africa where the sequence (or part of it) has been documented. The geochronological data set consists in the age ranges of each paleosurface tackled by radiometric ^{39}Ar-^{40}Ar dating of the neoformed oxy-hydroxides (i.e., cryptomelane, $K_{1-2}Mn_8O_{16}$, nH_2O, [4]) carried by their laterites at the Tambao reference site, Burkina Faso [1, 3].

Five groups of ^{39}Ar-^{40}Ar ages, $\sim$ 59 - 45 Ma, $\sim$ 29 - 24 Ma, $\sim$ 18 - 11.5 Ma, $\sim$ 7.2 - 5.8 Ma, and $\sim$ 3.4 - 2.9 Ma, characterize periods of chemical weathering whereas the time laps between these groups of ages correspond to episodes of mechanical denudation that reflect physical shaping of the paleosurfaces. For the last 45 Ma, the denudation rate estimates (3 to 8 m Ma^{-1}) are comparable with those derived on shorter time scale (10^3 to 10^6 y.) in the same region by the cosmogenic radionuclide method [2]. Combined with the geomorphologic data set, these age ranges allow the visualization of the regional variability in the estimates of local relief and denudation rates for several time spans defined between selected paleosurfaces in the sequence. Denudation rates, ranging from $\sim$ 4 m to $\sim$ 25 m Ma^{-1}, reflect overall acceleration of erosion rates in the Neogene. The observed space-time variability of the denudation rates suggest the interplay of (1) duration and intensity of climatically driven physical erosion periods, (2) absolute elevation and position of the considered sites with respect to the main continental divides, and (3) potential reorganization of the large-scale drainage. The results provide a new perspective for the detection, dating and quantification of subtle epeirogenic movements in West Africa, once combined with the sedimentary record of Cenozoic intracratonic and coastal basins.

[1] Beauvais, A., Ruffet, G., Hénocque, O., Colin, F., 2008. Chemical and physical erosion rhythms of the West African Cenozoic morphogenesis: The ^{39}Ar-^{40}Ar dating of supergene K-Mn oxides. J. Geophys. Res. Earth Surface 113, F04007, doi :10.1029/2008JF000996.

[2] Brown, E.T., Bourlès, D.L., Colin, F., Sanfo, Z., Raisbeck, G.M., Yiou, F., 1994. The development of iron crust lateritic systems in Burkina Faso, West Africa examined with in-situ-produced cosmogenic nuclides. Earth Planet. Sci. Letters 124, 19-33.

[3] Colin, F., Beauvais, A., Ruffet, G., Hénocque, O., 2005. First ^{40}Ar/^{39}Ar geochronology of lateritic manganiferous pisolites: Implications for the palaeogene history of a West African landscape. Earth Planet. Sci. letters 238, 172-188.

[4] Vasconcelos, P.M., 1999. K-Ar and ^{40}Ar/^{39}Ar geochronology of weathering processes. Ann. Rev. Earth Planet.

Sci. 27, 183-229.