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Coupled sedimentary evolution of the Congo Basin and equatorial west-African Margin : a Cainozoic record of tectonic and climate forcings

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The equatorial west African continental margin comprises depocenters located offshore major river mouth (e.g. Ogooué, Congo, Cunene...). Accumulation rate in these deep-sea-fans steadily increases as from Early Oligocene, and reaches a maximum in the Plio-Quaternary time. Such increase in terrigenous sedimentation indicates an increase of continental erosion in the corresponding watersheds, throughout Cainozoic.

Firstly, sedimentary sources were traced in the better constrained Ogooué watershed, using U-Th dating of single detrital zircon taken from alluvium samples, as well as from the formations exposed in the drainage area. Two distinct major terrigenous sources are identified: the Archean craton and an eolian Palaeogene sandstone formation. The ratio of their relative contribution with their respective exposure suggests a mechanical erosion of the unlithified aeolian formation, up to 20 times more efficient than that of the craton. Reworking by erosion of the former provides up to 1/3 of the present-day clastic flux delivered to the margin by the Ogooué.

Secondly, since the aeolian Palaeogene formation extensively crops out in the Congo watershed, we hypothesize that its reworking by erosion contributed to a large extend to the sediment accumulation in the margin and deep-sea fan. Indeed the Congo river network significantly incises this formation. However, preserved abandonment surfaces allow i) to construct the isopachs of the Palaeogene formation initially deposited on the continent, and ii) to calculate the eroded volume. Our results show that >75% of the Palaeogene formation has been removed by later erosion, and that it contributes some >35% of the volume of the Neogene Congo deep-sea fan.

Finally, in terms of source-to-sink, long-term evolution, these results reveal the following points:
- During Palaeogene, an arid climate i) decreases sediment flux towards the margin by rivers, leading to: ii) condensed stratigraphic section in the margin and deep-sea fans, and iii) favours aeolian deposition on the continent, especially aggradation in the endoreic Congo basin. Long-wave (>200km), low amplitude (<500m) warping of the Palaeogene abandonment surfaces suggests later (Neogene), moderate uplift of the coastal area.
- From the Eocene-Oligocene transition, the terrigenous flux to the margin and deep-sea fans resumes, and it drastically increases during Neogene. The formation previously deposited on the continent is reworked by erosion, and incision reaches the craton, which then becomes a sediment source. The deep-sea fans become the major sinks. These changes are related to a wetter climate, which promotes erosion and favours sediment export by a large river system.