Structure and Tectonic Evolution of the Intracratonic Congo Basin – an update

Francesca Maddaloni[1], **Damien Delvaux**[2], Etienne Kadima[3], Magdala Tesauro[1,4]

[1] *University of Trieste, Department of Mathematics and Geoscience, Trieste, Italy*

[2] *Royal Museum for Central Africa, Dept. Earth Sciences, Tervuren, Belgium*

[3] *University of Lubumbashi (UNILU), Democratic Republic of the Congo*

[4] *University of Utrecht, Department of Geosciences, The Netherlands*

+32 471 97 84 10, damien.delvaux@africamuseum.be

1. INTRODUCTION

The Congo Basin (CB) in Central Africa is one of the oldest, largest and least explored intracratonic sedimentary basin. It has been explored for hydrocarbons in the 1950's and the 1980's but, since that time only its peripheral parts have been investigated through field campaigns. Despite the large geo-resources potential of this basin, the existing geophysical and geological data have not been fully exploited and important scientific questions about its structure and tectonic evolution remain. The CB has been repeatedly reactivated by compressional and extensional tectonic events acting on a global and local scale [1] and thus represents a natural laboratory for investigating the processes that govern the long–term evolution of the continental interiors. Its mechanisms of formation and evolution are now investigated by F. Maddaloni of the University of Trieste in the frame of a new Ph.D project. The first step of this project – and the object of this presentation – is to reconstruct the structure and tectonic evolution of the CB using all available geophysical and geological data (aeromagnetic, reflection and refractions seismic, borehole, and field data) to obtain a model that will be later constrained by satellite gravity data and density measurements from rock samples.

2. MATERIALS AND METHODS

We re-examined the total of 2900 km of reflection seismic profiles shot along 39 lines covering a large part of the basin between 1974 and 1976 by a Esso-Texaco consortium. The seismic profiles have been calibrated by two stratigraphic fully cored ca. 2.000 deep wells drilled between 1952 and 1956 by the REMINA and two ca. 4200 m deep exploration wells drilled in 1981 by Esso Zaire. We reconstructed the general stratigraphy using as further constraints data outcropping on the basin margins, taking the advantage of the apparent lateral continuity of the stratigraphic units. The interpreted TWT profiles have been converted into depth profiles and used to compute by kriging interpolation maps of major seismic horizons. These were combined to define the isopach maps of the main seismic units. The available aeromagnetic data have also been used to define the basin contour and a central magnetic anomaly.

3. RESULTS AND DISCUSSION

3.1. Stratigraphic and tectonic evolution

The initiation of the CB is now believed to be contemporaneous with the onset of the Mbuji-Mayi Group in the Kasai region, which is assumed to be the lateral equivalent of the basal series of the CB. This group has been recently dated as late Mesoproterozoic [2], making the initiation of the CB as contemporaneous with the onset of the Taoudeni basin, about 1.1 Ga ago. Its stratigraphy has been subdivided into 4 major units [3]: the late Mesoproterozoic (aborted rift stage), Neoproterozoic (post-rift stage), Palaeozoic-Triassic and Jurassic-Cretaceous. They are separated by two major tectonic unconformities at the Neoproterozoic-Palaeozoic transition (related to the Pan-African deformation) and at the Palaeozoic-Jurassic transition (related to far-field intraplate compression). The effects of these deformations are clearly visible in various parts of the profiles and indicate a relative tectonic instability of the CB in response to intraplate stresses.

3.2. Internal structure

The depth to basement map (Fig.1) shows a similar structure as already earlier known, but differ in many details. It is characterized by WNW-trending deep depressions and highs. The deepest parts, reaching up to 10-11 km deep are separated by a central structural high. This is well expressed in the western side of the CB by the Congo River seismic section (Lokoro and Busira sub-Basins separated by the Kiri High), in the central part, by the Gilson sub-Basin and Boleko High, and in the eastern side, by the Dekese sub-Basin, Lokonia High and Lomami sub-Basin.

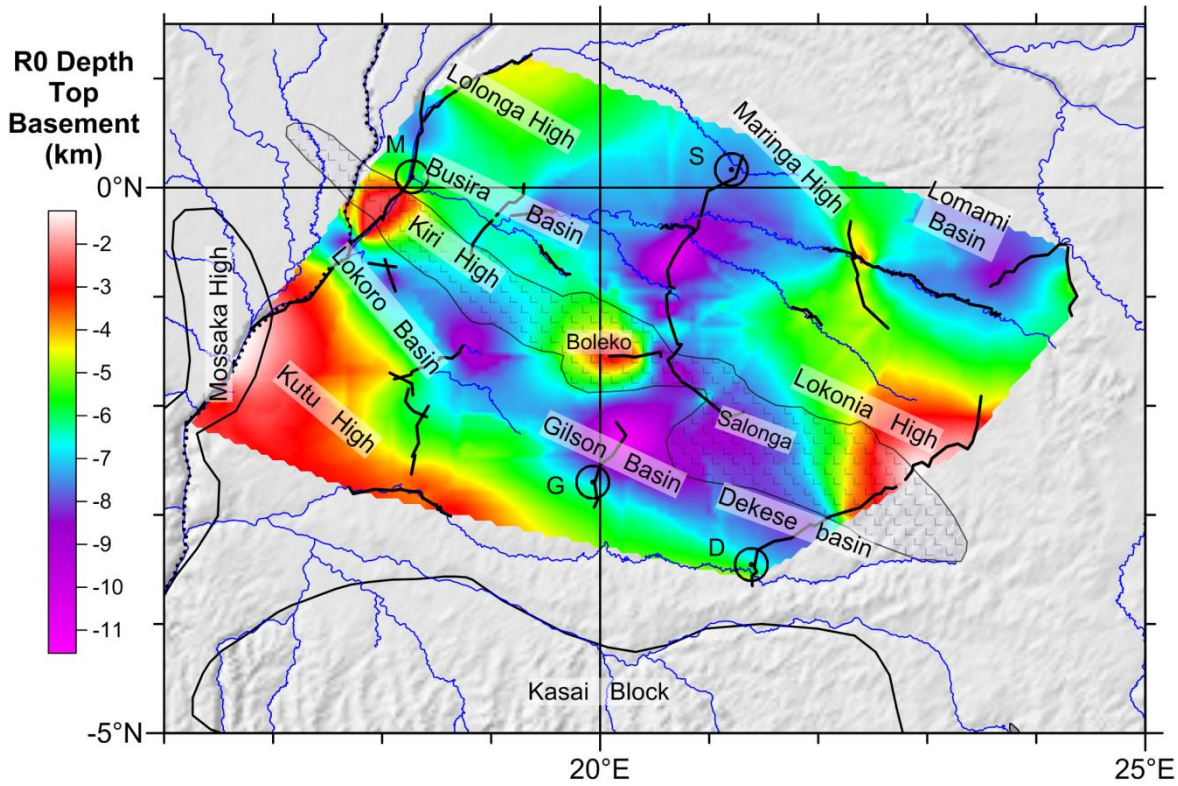

Fig.1: Interpolated map of the top to basement of the Congo Basin using the interpreted Esso-Texaco reflection seismic profiles. Black broken lines show location of the seismic profiles. The contour of the basin (smoothed black lines) and the central magnetic zone (grey shaded) are from the interpretation of the aeromagnetic data.

The succession of the isopach maps of the main stratigraphic units evidence the multistage evolution of the CB, with a strong imprint of the initial WNW tectonic trend. The latter is probably issued from the failed rift that is supposed to have initiated the basin. The influence of this rift phase decreases with time, as shown by the isopach maps of the younger sediments.

4. References

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