



Paper written by a doctoral student from a graduate program at UFRGS sets a new age for the Cretaceous period

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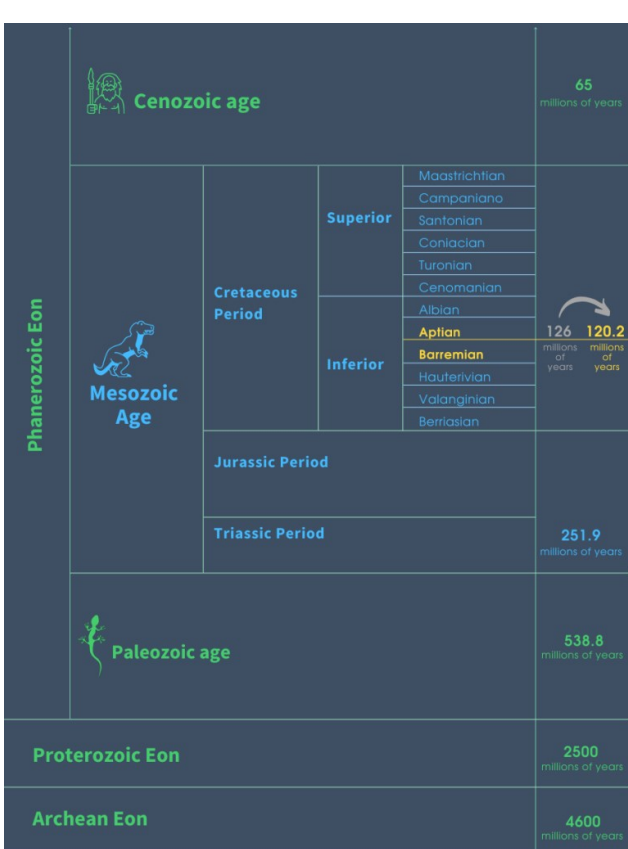
Geosciences | Study proposes changes on the geological time scale, done as part of a Petrobras project

*By Geovana Benites

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*Photo: Tânia Regó/Agência Brasil - One of the project's objectives is to establish a temporal link to understand which events led to the formation of major oil and gas fields, the so-called pre-salt layer, and when they occurred

Published in the journal Nature Communications and written by Carolina Gonçalves Leandro, a doctoral student in the Geosciences Graduate Program at UFRGS, the article "Astronomical tuning of the Aptian stage and its implications for age recalibrations and paleoclimatic events" set a new age for the boundary between Barremian and Aptian, two stages of the Cretaceous period. Previously, this boundary had been dated at 126 million years; however, the new proposal sets it at 120.2 million years, altering the geological time scale. The study also determined the age and duration of oceanic anoxic events, characterized by massive environmental changes, like low ocean oxygenation, extinctions of species and the formation of large oil and gas fields.



Change in geological time scale proposed by the study is highlighted in yellow.

The study was supervised by Professor Jairo Francisco Savian from the Department of Geology at UFRGS and it originated from the initiative "Processing and interpretation of magnetostratigraphic data from Brazilian Basins from the Cretaceous", by Petrobras (Brazilian state-owned oil company). "This project was a game changer for paleomagnetism in Latin America and Brazil, particularly because it led to the creation of the paleomagnetism laboratory in São Paulo," says Jairo, first doctoral student to participate in the project that began in 2010.

The main objective is to find a temporal connection to understand which events led to the formation of large oil and gas camps, now called pre-salt, and when they happened. From data obtained in other regions of the planet, it is possible to create a sort of template and compare it with the geological questions specific to Brazil. "This social role that Petrobras has — of funding academic research projects — is essential for us to compete internationally at a level of work of this significance," the professor explains.

New Findings

As soon as Carolina started her doctoral training, her objective was to study the electromagnetic field variation during the Cretaceous Normal Superchron. However, as she started to work with the available data, she and her supervisor realized that, beforehand, they would need a more accurate age model to place that information in a timeline, and the main problem was in the Barremian-Aptian boundary. As there were no absolute dates to assist in understanding these ages, it was necessary to seek new tools to determine the duration of the studied period and the age for the boundary. To build the model, cyclostratigraphy was employed, which is a subdivision of stratigraphy (a branch of Geology that describes and classifies rock layers, correlating them in space and time). This procedure investigates cyclic sedimentary patterns and their formation, influenced by processes that occurred on different time scales, such as climatic and tectonic. Aided by cyclostratigraphy, they were able to elaborate an age model with a temporal resolution of 405 thousand years.

"These results that we have just published align with what was published in the last geological time scale. Thus, we can conclude that this interval, which was believed to be 126 million years old, has a boundary, according to our findings, of 120.2 million years. This affects many already published studies that used the previous age interval."

— Carolina Gonçalves Leandro

In order to verify the new model, they had to date and correlate the anoxic oceanic events of that age, that is, the sedimentary records of ocean anoxia. These events can be a result of intense volcanism, like the Ontong Java Plateau, which has the same volcanism age as the Aptian events. The latest reversal of the geomagnetic field before the Cretaceous Normal Superchron, the M0r, also had to be dated, as it marks the Barremian-Aptian transition. All these events showed discrepancies in sediment datings.

Ontong Java Plateau came from a large igneous province formed in the Indian Ocean during the Cretaceous Superchron. These provinces release a certain quantity of material in the atmosphere that is lethal for some species. According to Jairo, many researchers used to date the sediments from Ontong Java Plateau in 121 million years, different from the 126 million years previously proposed.

An important event marking the Barremian-Aptian transition, M0r is the last magnetic field reversal before the event Carolina referred to as the Cretaceous Normal Superchron, initiated at 120 million years with the new dating and extending until 83 million years on the timescale. "Basically, for 38 million years, the magnetic field remained still, there was no polarity reversal. So, another problem is precisely that we have no reversals to date these rocks. Finding this last one is crucial. These scientists found the M0r there, dated with a lot of precision, which wasn't compatible to what the biostratigraphy experts were proposing," concludes the researcher.

"We have to emphasize that this is the first study that provides the duration of all these anoxic events that happened during the Aptian and they are preserved in the core sample we studied. The bibliography we used shows only a few events' ages and durations."

— Carolina Gonçalves Leandro

The work continues

According to Jairo, these research results have consequences in other fields. "In the next few years, we will see a change in the discussion surrounding these events. There will be many studies about the magnetic field variation, mineralogy and the magnetic minerals that were formed during this climatic stress, during these anoxic events variations," he adds.

Another study by the research group correlates the Sergipe-Alagoas oil basin with the Tethys, an ocean that was already open during the Aptian period. According to the professor, this is the first building block to compare data on a global scale "The next steps will be creating new projects that promote this type of study. We are also trying, through Petrobras, to build a paleomagnetism laboratory here at UFRGS. This lab will allow us to obtain the next data from Brazilian basins for the following decades," he finishes.

Translated into English by **Guilherme Faller**, undergraduate student enrolled in the course "Supervised Translation Training II (English)" of the Undergraduate Program in Language and Literature, under the supervision and translation revision of Professor Elizamarí R. Becker (P.h.D.) - IL/UFRGS.

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