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Palynological insights into the Eocene-Oligocene biostratigraphy, palaeoenvironment, and palaeoclimates of the Kwanza Basin, Angola

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ABSTRACT

New biostratigraphic and palaeoenvironmental data from Cabo de São Brás in the Kwanza Basin reveal over 40 m of marine sediments (Cunga and Quifangondo formations) spanning the Eocene-Oligocene transition. Well-preserved dinoflagellate cysts within these sediments provide precise age determinations and palaeoenvironmental insights. The Cunga Formation, ranging from the late Eocene to the Oligocene, is characterized by sporadic occurrences of *Diphyes colligerum*, *Glaphyrocysta semitecta*, *Schematophora* cf. *speciosa*, *Deflandrea heterophlycta*, *Rhombodinium draco*, and *Rhombodinium porosum*. The overlying interval reveals a Rupelian assemblage, including *Achomosphaera alcornu* and *Hystrichokolpoma* cf. *Pseudoceanicum*. The uppermost part of the Cunga Formation is marked by the lowest occurrence of *Tuberculodinium vancampoe* and the highest occurrence of *Achomosphaera alcornu* during the Chattian. In contrast to existing geological maps, the transition to the Quifangondo Formation reveals a continuous sequence from the uppermost Chattian, based on the occurrence of *Distatodinium paradoxum* and *Phelodinium africanum*, along with a significant acme of *Hystrichokolpoma* spp.

Palaeoenvironmental analysis suggests a marine setting with periods of both low and high productivity. Significant environmental transitions are observed, ranging from outer neritic to oceanic conditions at the base of the Cunga Formation (late Eocene-Oligocene, late Rupelian-early Chattian). In the late Oligocene, despite considerable terrigenous input, palynological data suggest predominantly inner to outer neritic conditions at the top of the Cunga Formation and the base of the Quifangondo Formation. Fluctuations in dinoflagellate cyst influxes reflect changes in water temperatures, providing insights into past climate shifts, during the Eocene-Oligocene transition, and offering a valuable framework for future palaeoclimatic investigations.

1. Introduction

During the Eocene to Oligocene, Earth underwent drastic climatic changes, fluctuations in sea levels, and tectonic activity, which led to widespread alterations in sedimentary environments globally. This period is characterized by a transition from a greenhouse to an icehouse state, marked by cooling temperatures, shifts in global ocean circulation, and significant changes in biodiversity (Zachos et al., 2001, 2008; Van Simaey, 2004; Fenero et al., 2013; Awad and Oboh-Ikuenobe, 2018; O'Brien et al., 2020).

In particular, the warming and subsequent cooling of global ocean temperatures during the Eocene-Oligocene transition caused significant

changes in marine environments, influencing the diversity and productivity of dinoflagellate cysts (dinocysts) (Bijl, 2023). These microfossils are vital for reconstructing past environments, playing a key role in biostratigraphy and aiding in the dating of sedimentary strata. Additionally, dinocyst assemblages provide valuable insights into palaeoenvironmental conditions, since they respond sensitively to both climate and sea level changes (Bijl, 2023).

The Kwanza Basin, located along the southwest African margin, is a critical area for studying the Eocene-Oligocene transition because it preserves rich fossiliferous successions that record past climatic changes in a low-latitude setting. Although extensive research has focused on the basin's tectonic evolution and hydrocarbon potential, the dinocyst

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