01 - THE CRYOGENIAN–EDIACARAN BOUNDARY IN THE MIRASSOL D’OESTE REGION, SOUTHERN AMAZON CRATON

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ABSTRACT

The Cryogenian-Ediacaran boundary is linked worldwide to the presence of well-defined cap carbonate that comprises a post-glacial succession related to the Neoproterozoic Snowball Earth glaciations. Occurrences of cap carbonate overlying Marinoan glaciogene diamictites (~635 Ma) are correlated for hundreds of kilometers along the Southern Amazon Craton, being the best example, the succession exposed in Mirassol d’Oeste, State of Mato Grosso, Center western Brazil. In this region, glaciogene sediments are overlaid by a ~40 m-thick cap carbonate with persistent ?^{13}C negative anomaly around -5‰ and ^{87}Sr/^{86}Sr variations consistent with Early Ediacaran age. The basal contact of cap carbonate exhibits soft-sediment deformation, indicating plastic adjustment between glacial diamicton and dolomuds representing the abrupt transition from icehouse to greenhouse conditions. This contact is unequivocally the record of the Cryogenian-Ediacaran boundary in the Southern Amazon Craton.

***Keywords**:* Neoproterozoic, Amazon Craton, Cap carbonate, Glaciation, Cryogenian-Ediacaran boundary.

INTRODUCTION

The study of the Late Neoproterozoic low-latitude glaciations and Precambrian and Cambrian fossil assemblages were the base for the subdivision of the Cryogenian (850-635 Ma) and Ediacaran (635–541 Ma) periods (Harland, 1964). Particularly, the Ediacaran were consolidated with elaboration of a precise sequential framework assisted by detailed $d^{13}C$ and $^{87}Sr/^{86}Sr$ data, as well as, the recognition of Ediacaran fossil such as acanthomorphic acritarchs and the first shelly fossil *Cloudina* (Xiao et al., 2016). Together with the establishment of the Ediacaran System (Knoll et al., 2004), the boundary at the base of the Nuccaleena Formation, a typical cap carbonate that overlies the Cryogenian diamictite of the Elatina Formation in South Australia was considered as a GSSP (Global Stratotype Section and Point). The Cryogenian-Ediacaran boundary is linked worldwide to the presence of well-defined cap carbonate that comprises a post-glacial succession, generally exhibiting negative isotopic excursion of ^{13}C, that overlying glaciogenic diamictites formed during low-latitude glaciations, linked to the Snowball Earth hypothesis (cf. Hoffman & Schrag, 2017). This work summarizes the studies carried out in the main Cryogenian-Ediacaran boundary in the South America preserved in the cap carbonate exposed at open pit of Terconi quarry, Mirassol d’Oeste region, State of Mato Grosso, Center-Western Brazil.

GEOLOGIC SETTING

Neoproterozoic carbonate platform deposits are discontinuously exposed on crystalline and metasedimentary rocks in the border of the Southern Amazon Craton and over Paraguay Belt (Figure 1). The collisional event that originated the Paraguay Belt is recorded mainly in the metamorphosed rocks of the Cuiabá Group (Figure 1). Post-collisional and non-metamorphosed intracratonic deposits are represented by Marinoan glaciogene deposits, Ediacaran carbonates and Cambrian-Ordovician siliciclastic rocks deformed by transtensional tectonics, marked by the emplacement of Cambrian granite (Nogueira et al. 2019). The transition of Ediacaran-Cambrian is confirmed by the record of shelly fossil *Cloudina* sp. (Warren et al., 2014) and *Skolithos* ichnofacies (Santos et al., 2017).

The platform carbonate deposits in Southern Amazon Craton is represented by the Araras Group, with more than 700 m thick divided into four formations, from the base to the top (Figure 1): 1) Mirassol d’Oeste Formation, a cap dolostone interpreted as shallow platform deposits; 2) the Guia Formation, comprising limestone and shale from deep platform deposits and its basal deposits integrate the cap limestone; 3) the Serra do Quilombo Formation, a moderately deep to shallow platform dolomitic succession; and the 4) Nobres Formation, dolostones and sandstones related to a peritidal environment. Cambrian siliciclastics deposits of Raizama Formation and Paleozoic deposits of intracratonic sedimentary basins unconformably overlie the Araras Group (Figure 1). Pb- Pb age of 622 ± 33 Ma were obtained for the cap carbonate (Romero et al., 2012). The younger age was confirmed by U-Pb detrital zircon values of 541 ± 7 Ma and 528 ± 9 Ma, and Ar/Ar detrital muscovite age of 544 Ma for Diamantino Formation, top of Alto Paraguay Group (Bandeira et al., 2012). Paleomagnetic data of cap dolostone revealed primary magnetization and paleolatitude of $22\pm6/-5^{o}$, indicating an equatorial-tropical position for Puga Glaciation (Trindade et al., 2003).

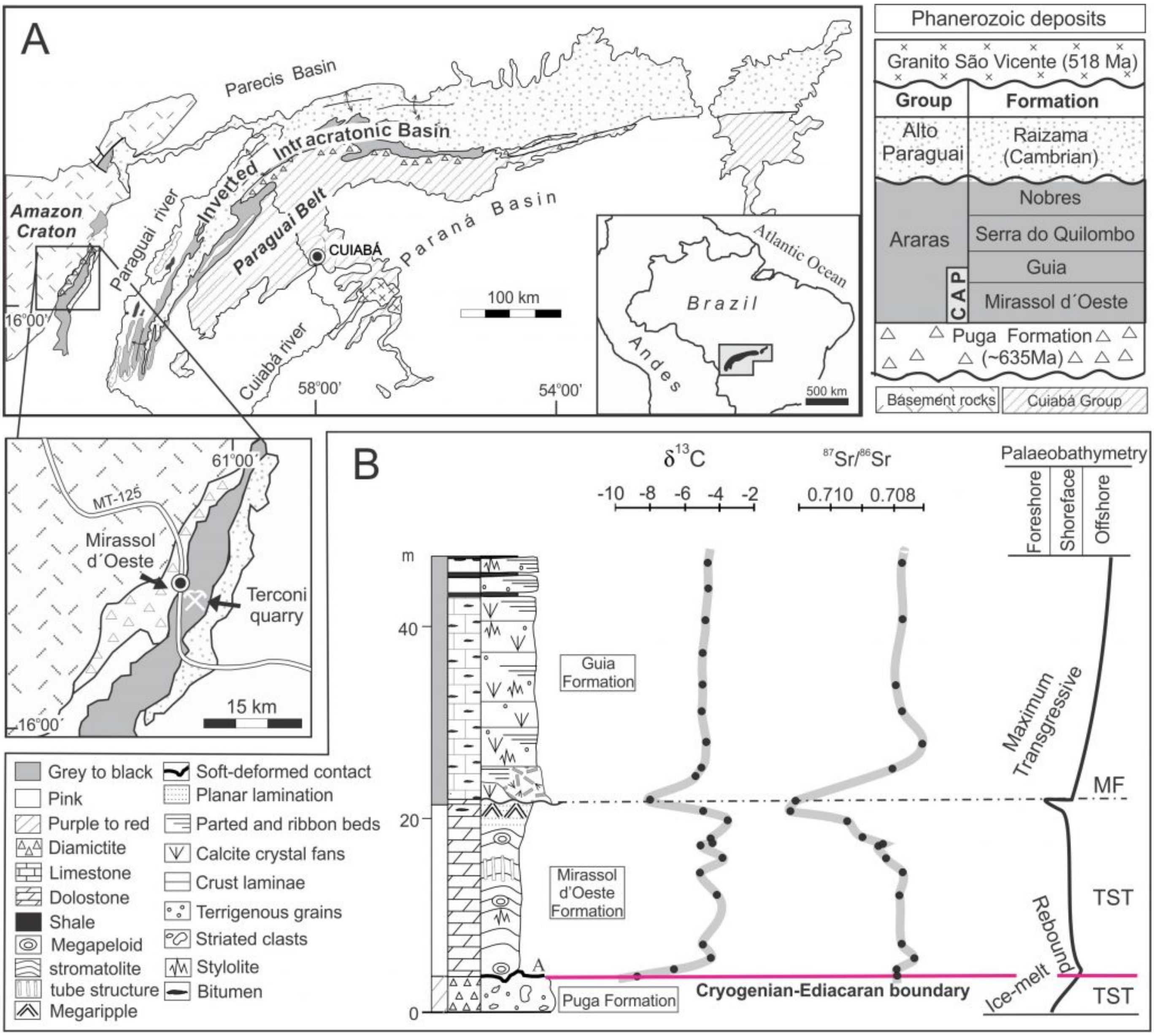

Figure 1. Geological setting of the Central Western Brazil. A) Tectonic and stratigraphic context of the Southern Amazon Craton with detach for the Mirassol Region and Terconi quarry. B) Stratigraphic section of cap carbonate in Terconi quarry with of ?13C and 87Sr/86Sr data, and paleo bathymetry variations. Abbreviations: TST - transgressive system tract, MF - marine flooding.

THE CAP CARBONATE AND THE CRYOGENIAN-EDIACARAN BOUNDARY

The cap carbonate is characterized by primary pinkish dolomites and limestones, displaying diagnostic structures such as, microbial laminites, tube structure, calcite crystal fans (after aragonite pseudomorphs), macropeloids and giant wave ripples (Sanjofre et al. 2011, Hoffman et al. 2017). Approximately 100 m-thick of coastal to marine glaciogene sediments are overlaid by a ~40 m-thick cap carbonate with persistent ?^{13}C negative values and ^{87}Sr/^{86}Sr variations consistent with Early Ediacaran age overlies

Marinoan diamictites (Figure 1). The cap carbonate consists of a basal cap dolostone, composed by shallow to moderately deep-water pinkish peloidal dolomudstone with stromatolites, tube-stone structures, giant wave-ripple and rare crystal fans; and 2) a cap limestone cementstone, consisting of deep-water bituminous fine limestones with abundant crystal fans, subordinate shales and frequent acritarches (Figure 1). The cap carbonate reflects deposition associated with coastal subsidence triggered isostatic rebound succeeded by further transgression and implantation of a $CaCO_3$-supersaturated deep-sea platform.

The contact between the dolostone and diamictites is sharp and plastically deformed developing load casted structures, indicative of a relatively fast precipitation of carbonates over partially unconsolidated glaciogenic diamictons (Figure 1 and 2). The synsedimentary deformation related to post-glacial isostatic rebound following the Marinoan Glaciation around 635 Ma (Nogueira et al., 2003). The glacioisostatic adjustment takes place after melt and retreat of a glacier, causing progressive regional uplift in continental areas (Creveling & Mitrovica, 2014), isostatic subsidence and relative sea level rise in the coastal zones. Considering the Pb-Pb age of 622 Ma and the ?^{13}C negative values and low ^{87}Sr/^{86}Sr variations consistent with an Early Ediacaran age, the contact observed in Mirassol d'Oeste is unequivocally the Cryogenian-Ediacaran boundary in Southern Amazon Craton.

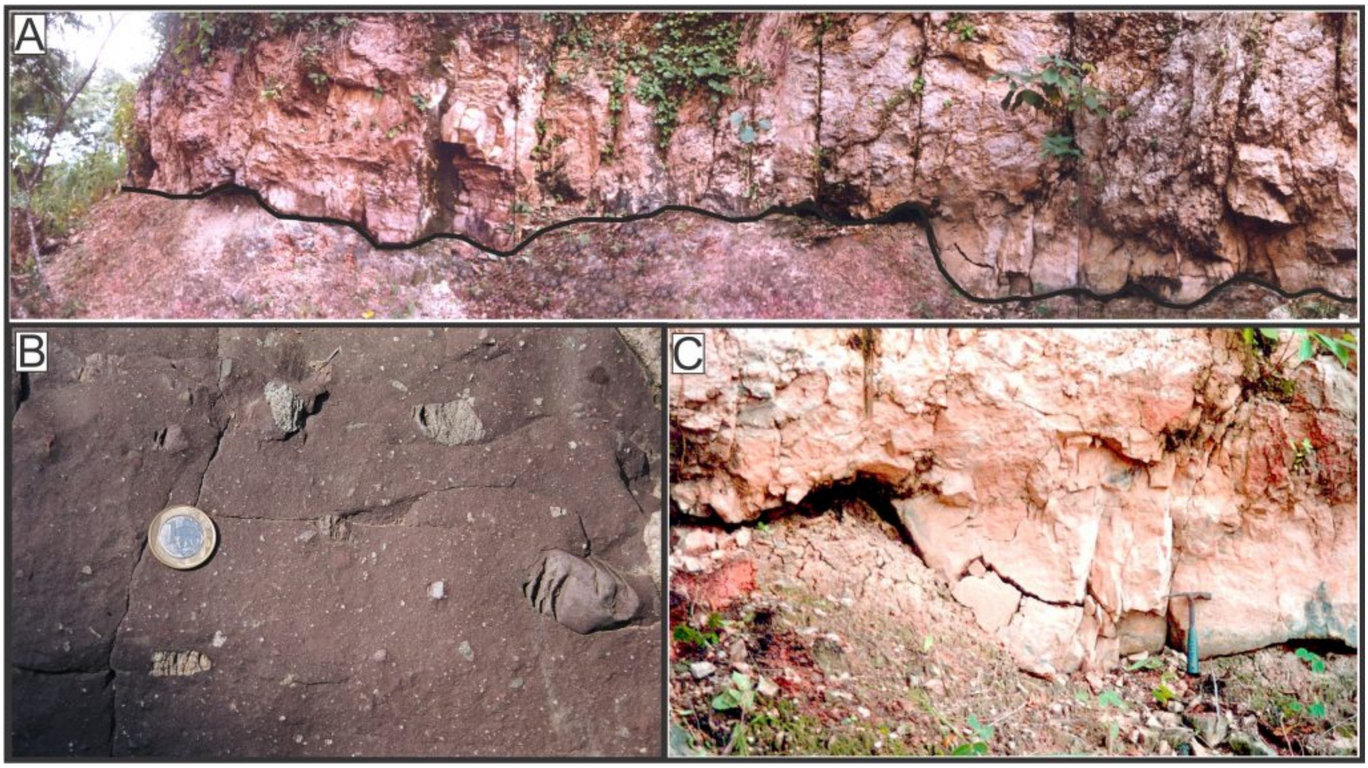

Figure 2. The Cryogenian-Ediacaran boundary in the Mirassol d'Oeste region. A) deformed contact between diamictites and dolostone. B) Diamictite. C) Large-scale load cast in dolostone.

CONCLUSION

The contact between Marinoan diamictites and the cap carbonate exposed in the Mirassol d' Oeste, Center-Western Brazil, represents the abrupt transition from icehouse to greenhouse conditions and is considered as the most preserved Cryogenian-Ediacaran boundary in South America.

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