GLACIOTECTONIZED PRE-GLACIAL REGOLITH OF ARCHEAN BASEMENT OVERLAIN BY NEOPROTEROZOIC GLACIO-MARINE LAMINITES, SÃO FRANCISCO CRATON, BRAZIL

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Rudaceous deposits resting on Archean orthogneiss and overlain by laminites/rhythmites situated below carbonates of the Neoproterozoic Bambuí Group, in central-eastern State of Minas Gerais, Brazil, contain evidences of deposition in a glacially influenced setting. Similar rudaceous beds on the São Francisco craton, of controversial glacial origin, are usually correlated with the Jequitaí Formation (Neoproterozoic), for which a glacial origin has been well established. Laminites have been included in the lowermost Pelitic Facies of the Bambuí Group, which has been interpreted as a record of the Sturtian glaciation in Brazil.

At the main outcrop near Formiga town, the rudaceous bed, highly variable in thickness (cm-2m) corresponds to regolith debris composed of rounded corestones of variable sizes, up to 2m, some only partially detached from the local basement, and conglomerate of angular cobbles in a sandy-clayey matrix, identified on top of a humocked basement of Archean gneiss. Regolith particles were entrained in the basal dirty layer of a glacier, transported, lodged and sheared on stoss sides and tops of humocks. The ancient weathering phase was superposed by a recent one. In spite of that detailed features of the rocks have been exceptionally well preserved (Figure 1).

Features diagnostic of subglacial simple shear include clast stretching, imbrication, boudinage and attenuated folds indicative of a ductile regimen. These processes led to comminution of weathered gneiss fragments, ultimately resulting in an up to dm-thick, finely interbedded, transposed laminae of gneiss and silt-clay. Intensity of deformation varied laterally, as demonstrated by thickness of the deformed bed (deformed tillite), sizes and shapes of clasts and distribution of deformation features. At places the deformed bed is represented by one clast-thick boulder pavement, highly compressed against the gneiss surface. No clear change in the vertical intensity of shear was observed.

Deformation affecting the gneiss, immediately below the deformed tillite, includes small thrusts and fractures indicative of a brittle regimen of the local substratum. All these features point consistently to a glacier moving toward east, probably in a terrestrial setting.

Regolith debris are undisturbed on top of basement lows. These areas probably represent cavities on the lee side of humocks. Debris may in part correspond to rock particles liberated by melting from ice roof over lee subglacier cavities.

Retreat of glacier during deglaciation was followed by sea level rise and transgression over the glacial deposits, probably establishing a glacial-marine setting. Deglacial sedimentation is documented by the laminites made up of two superposed units of finer (mm) and thicker (cm) couplets of silt-clay rhythmites. The lower unit fills an ample depression and other minor irregularities on the gneissic basement showing the laminae deformed around large corestones. Resulting undulating bedding attenuates upward.

The lower rhythmites (up to 2m thick) are overlain along a sharp contact by the section of thicker rhythmites (10m of exposed thickness). Sedimentary features of the fine rhythmites are difficult to observe, but may include graded bedding. Graded bedding is clearly observed in couplets of the thicker rhythmites. Both lithofacies seem to have been deposit by a combination of settling of silt-clay particles from plumes derived from the glacier terminus (rain-out) and turbidity currents. Dropstones have not been found in the rhythmites.

Available maps demonstrate an extensive distribution of silty-clayey laminites similar to the ones here discussed, but at places intercalated with fine sandstone beds, in southeastern Minas Gerais, found either resting on thin diamictite bed or directly on the Archean gneissic basement. A very peculiar exposure examined at the SAFFRAN quarry, some 50km N from Formiga, which is over 60m thick, differs by being made up of interbedded kaolinite and ferruginous laminae. Sets of straight to curved striae and shallow furrows found on distinct areas of a single bedding surface are provisionally assigned to an episode of floating ice scouring of bottom sediments. Round depressions at the end of shallow furrows may indicate sites of former dropstones. Genesis of the SAFFRAN laminites is still not

entirely clear, but seem to involve setlling of clay particles introduced in the marine environment by sediment plumes sourced at highly weathered, kaolinite rich, gneissic terrain. Clay deposition alternated with precipitation of hematite in analogy with the formation of BIF suggests that the region was not totally covered by ice at the time of deposition.

Laminites studied are distinct from other silty-clayey units (Santa Helena and Serra da Saudade formations), stratigraphically higher in the Bambuí Group and may deserve a separate formational name.

Ample distribution of the rather homogeneous unit described herein, and rarity/absence of dropstones suggests the deposition took place in a distal marine setting with regard to glacier margin. One may note, however, that fast evacuation and suppression by fast ice have been proposed to explain absence of icebergs in laminites in glacial-marine estuaries. Features described herein do support the concept of open marine conditions during the Neoproterozoic in Brazil.

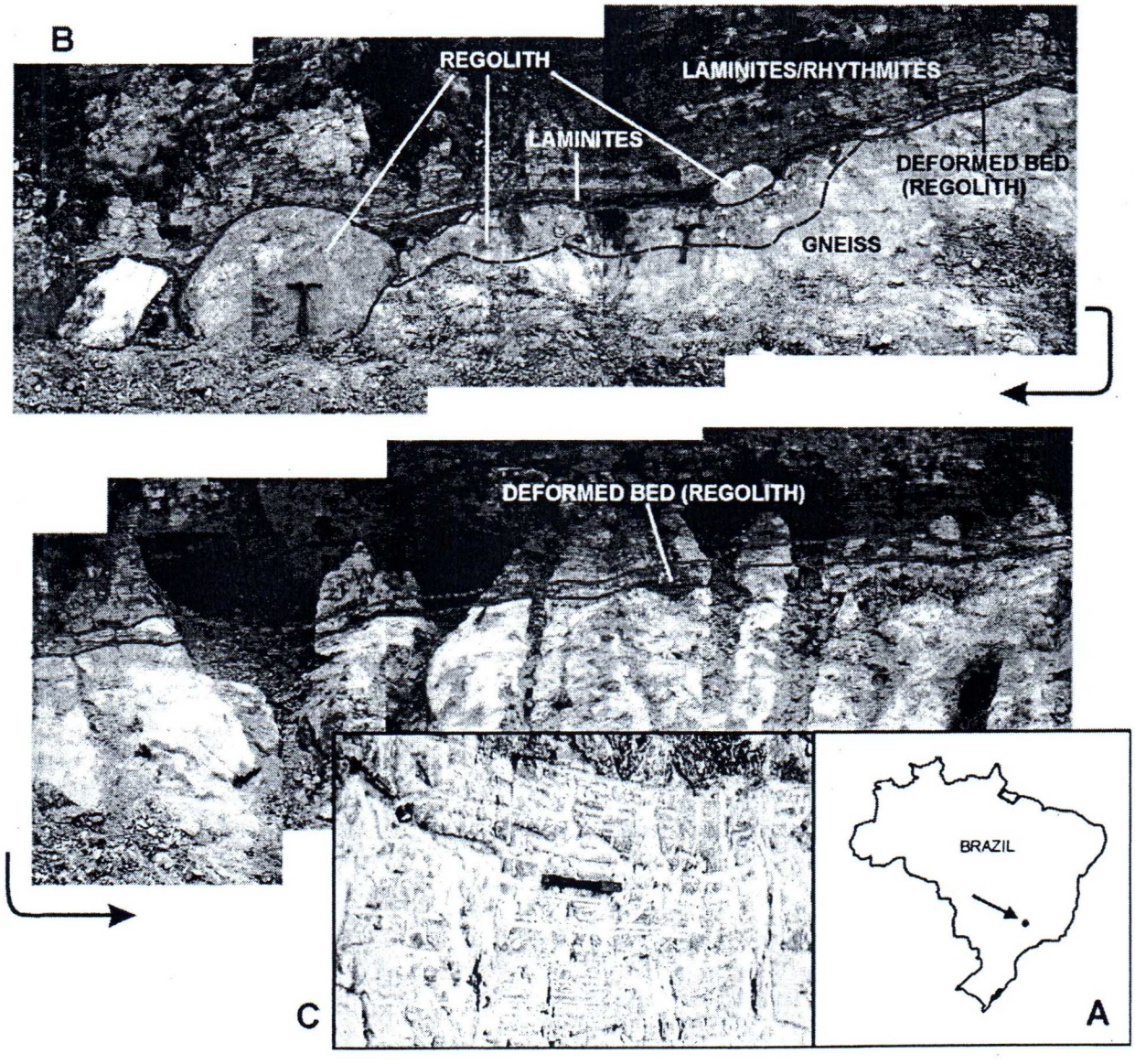

Fig. 1. A) Study area in Minas Gerais, Southeastern Brazil; B) Deformed bed and laminites/rhythmites (Neoproterozoic) overlying Archean gneiss at roadcut of road BR354, near Formiga, Minas Gerais, Brazil; C) Striae on top of laminites at SAFFRAN Quarry, near Bom Despacho, Minas Gerais.