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**ABSTRACTS**

## LATE PALEOZOIC LANDFORMS OF GLACIAL EROSION AND GLACIAL GEOLOGY ON THE SOUTHERN FLANK OF THE PONTA GROSSA ARCH, PARANÁ BASIN, BRAZIL

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Landforms of glacial erosion of micro-scale (striae and furrows) occur on sandstone of the Furnas Formation (Devonian), and on overlying fluvio-glacial sandstones and subglacial tillites from the basal part of the Itararé Subgroup (late Paleozoic) on the southern flank of the Ponta Grossa arch (Bigarella *et al.*, 1967; Fig. 1). Although discontinuous, outcrops make up two stratigraphically superposed (dm to m apart), extensive landscapes of glacial erosion of over 1,500 km<sup>2</sup> of area, exhumed and well preserved. Features on the Furnas sandstone have been produced by a glacier flowing on a hard (consolidated) bed; glacier bed was soft or unconsolidated on the Paleozoic sediments (Figs. 2 and 3). In spite of the different rheologic behavior of the glacier, bed erosional features present on the two types of glacial substrata are similar. Subglacial plowing was the predominant erosional process in both cases, probably associated to warm base glaciers and presence of subglacial meltwater. Only rare indications of meltwater erosion have though been found.

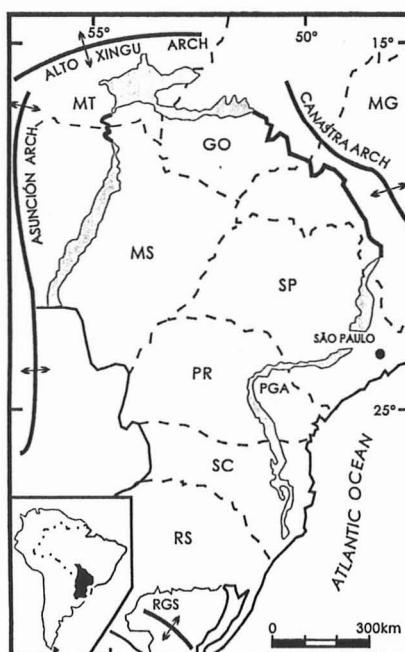


Fig. 1: Location of the study area. Gray= Itararé Subgroup; PGA= Ponta Grossa arch; RGS= Rio Grande do Sul shield; MG= Minas Gerais; GO= Goiás; SP= São Paulo; PR= Paraná; SC= Santa Catarina; MS= Mato Grosso do Sul; MT= Mato Grosso.

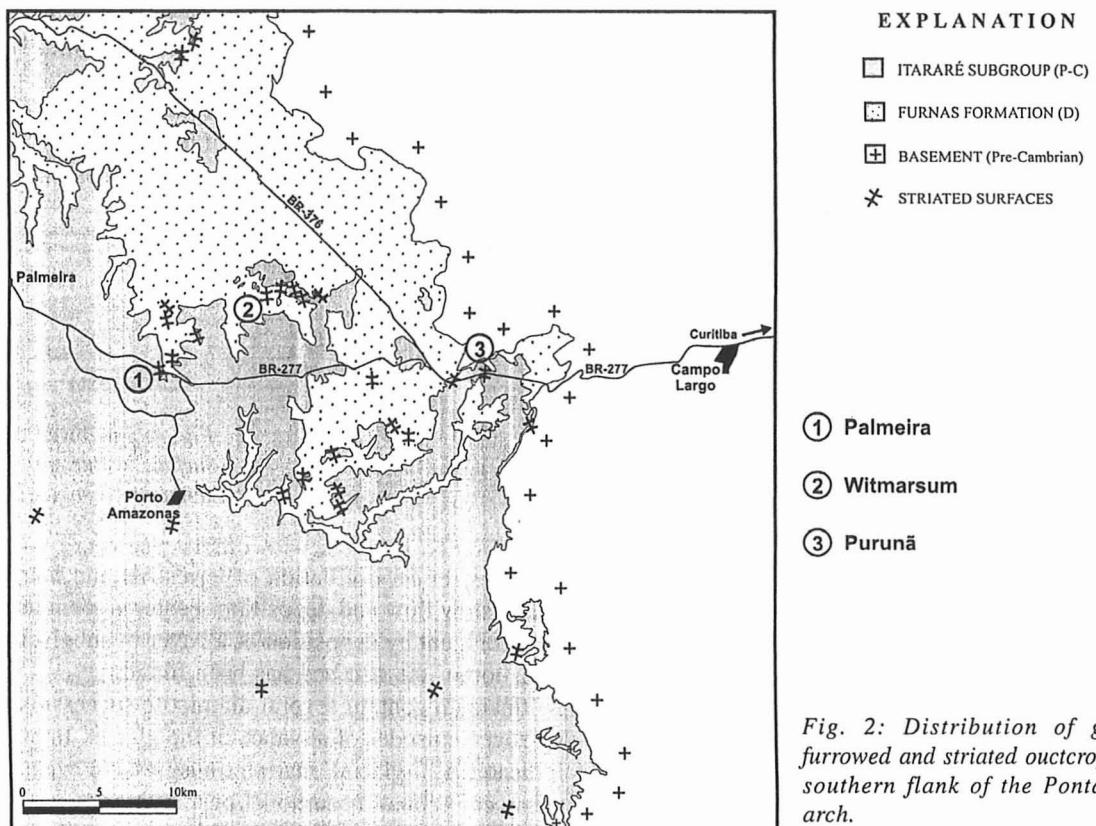


Fig. 2: Distribution of glacially furrowed and striated outcrops on the southern flank of the Ponta Grossa arch.



Fig. 3: Furrowed and striated pavement on top of Devonian sandstone of Witmarsum. Sense of glacier movement towards the upper part of photo.

In spite its hardness, positive, meso-scale, glacial erosional features, as *roches moutonnées*, whalebacks, etc., do not occur on the Devonian sandstone. This is probably due to the glacier having displaced on a previously existing peneplain formed during a pre-Itararé Subgroup regional erosional phase, plus the homogenous lithology and horizontal disposition of beds of the sandstone.

The mean directions of striations are N12°W (eigen value 0.955) and N20°E (eigen value 0.938) on the Devonian (Fig. 2) and late Paleozoic rocks, respectively. In the absence of other indicators, general sense of glacier flow towards north has been established on the basis of fabric of diamictites and cross-bedding measurements on sandstones of the Itararé Subgroup. Close parallelism of features on each erosional surface and absence of intersecting sets strongly support occurrence of single erosional events. The glacially eroded landscapes have been previously assigned to two different successive "glaciations", respectively named Rio do Salto and Cancela. Mode of occurrence of features and stratigraphic considerations point instead to two glacier advances, the oldest on top of the Devonian sandstone and the youngest on deposits left by the first advance. Preservation of the striated and furrowed surfaces was by deposition of a layer of basal till and of other sediments on top of them.

In addition to the two basal ones, other less extensive exposures of furrowed and striated surfaces occur in the studied area on top of fluvio-glacial and glacial-marine sandstones, and on lodgement tillite of the Itararé Subgroup, respectively in Witmarsum and Palmeira, and São Luís de Purunã. The glacier bed in all cases was soft. The surfaces are also notable for being multiple, that is, stratigraphically repeated (2-4), only dm apart from each other, and bearing parallel features. In Witmarsum two furrowed and striated surfaces occur on bedding planes of shallow marine sandstones. At least four different striated and furrowed surfaces were recognized on fluvio-glacial sandstone at Palmeira.

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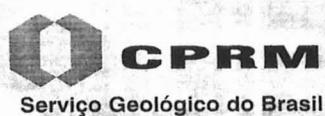
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