

The Thermal Effect of Basic Sill on Turbidites of Taciba Formation (Permian), Parana Basin, Brazil

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ABSTRACT

The pyrometamorphism is the result of high temperatures and very low pressures caused by the intrusion of hypabyssal bodies, combustion and lightnings into sedimentary rocks, with or without interchange of material. It is well known that the Paraná Basin (Ordovician-Cretaceous) offers examples of this thermal effect, nevertheless most of the scientists have been studying bodies and their effect over oil maturation, with fewer works focused on effects over fossiliferous content. Here we report the thermal effect of a basic sill from the Serra Geral Formation (Early Cretaceous) on sedimentary rocks from Taciba Formation (Permian) at Claudemir Rertz outcrop, Itaiópolis, Santa Catarina, based on palynofacies, macrofossil content and X-ray microtomography sample reconstruction. This outcrop comprises a 4.5 meters fossiliferous turbidite (Te – division of Bouma sequence, laminated to homogenous mudstones, subdivided in 9 levels) covered by a sill (5 m thick). The palynofacies technique consists on the evaluation of kerogen components after removing the mineral matrix, and has been applied to support paleoenvironment interpretations for at least two decades in Brazil. Besides, palynofacies can be used to measure the thermal effect on kerogen components. The analysis criteria to measure the effects of the pyrometamorphism were the non-opaque phytoclast color variation and the difficult to identify their subdivision, which shows a decrease of the effect into the base of the turbidite. These samples are essentially formed by three kerogen groups (Amorphous Organic Matter, Phytoclast and Palynomorphs), with high phytoclast concentration. On the base (0.5m) no effect has been observed, while at 1 meter only a subtle color variation occurs. Through the subsequent levels (1.5-3m) a progressive effect has been noticed in both criteria, with values of burned non-opaque phytoclasts varying from 9.43% (1.5m-level 3) to 67.6% (3m-level 6). From levels 7 to 9 (3.5-4.5m) all the observed non-opaque phytoclasts are burned. Furthermore X-ray microtomography samples reconstruction on turbidites of levels 2, 4 and 9, showed a variation of thermal effect on the porosity, with level 2 showing no porosity, level 4 with 0.55%, and level 9 without porosity and with greater hardness. These porosity variations on lower levels are possibly generated due to sample fragmentation during the analysis, with the sample of level 2 fragmenting before the X-ray tomography application and level 4 sample fragmenting after the analysis. All these variations may be associated with the late sill intrusion. Comparing the data from palynofacies, X-ray microtomography and considering that the macrofossil content is almost all formed by prints of calcarean sponge spicules, which have their calcium carbonate burned by the late heat, we infer that fossil and primary porosity preservation of Taciba Formation has been negatively affected by the sill, with thermal effectiveness of 3.5 meters beneath the intrusion. Sill geochemistry analysis showed a compositional variation on silica and titanium oxide, varying from 51.02 and 3.19 (high-Ti basalt) on the base, respectively, to 60.23 and 0.65 on the top (low-Ti andesite), which can probably indicate two different intrusions, associated with the higher thermal effect observed on this outcrop compared with others on the region.