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Pre- to late transcurrent plutons in eastern Borborema Province (NE Brazil): kinematic and temporal constraints on the Brasiliano Orogeny

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High-temperature metamorphism, large transcurrent shear zones, and an intense magmatic activity are the main characteristics of the Brasiliano/Pan-African Orogeny in eastern Borborema Province (NE Brazil). Recent structural, petrologic and geochronologic studies of plutons in this area have helped to constraint its tectonic evolution during the late Neoproterozoic. The plutons can be classified, according to their relationships with the shear zones, as pre-, early-, and syn- to late tectonic. 640-630 Ma-old plutons have been variably affected by solid-state deformation and show shallow to moderately, commonly SE-dipping foliation conformable with the regional fabric of country rocks. Subvertical shear bands locally crosscut this fabric, attesting to intrusion prior to the strike-slip deformation. 590-580 Ma-old plutons are commonly bounded or crosscut by large transcurrent shear zones, and a transition from submagmatic to high temperature solid-state deformation is observed approaching the mylonitic belts. The internal magmatic structure varies from pluton to pluton, but may be simplified as consisting of two coexisting distinct fabric patterns. The dominant fabric is represented by steeply dipping foliation and shallow plunging NE-SW to E-W trending lineation, parallel to the mylonitic fabric encountered in shear zones. A secondary, but well-developed, family of structures consists of shallow to moderately dipping foliation and NW-SE trending lineation, which is inferred to have formed during an earlier thrusting event before strain localization along the shear zones. These plutons were therefore emplaced just before or at the very early stage of movement along the shear zones. Plutons emplaced in the advanced stages of strike-slip shearing contain xenoliths of mylonite and were deformed at lower temperature conditions (lower amphibolite to greenschist facies) than the older plutons. Precise ages are not

available for these late-transcurrent plutons, but their acquisition in the near future will allow estimating the duration of strike-slip motion.

The 640-630 Ma-old plutons comprise two compositional groups of calc-alkalic rocks: (i) equigranular, epidote-bearing granodiorites and (ii) an association of coarse-grained granites and diorites. The 590-580 Ma-old plutons include high-K calc-alkalic coarse-grained to porphyritic granitoids and biotite diorites, and shoshonitic syenites. The late transcurrent magmatism is more heterogeneous and comprises peraluminous two-mica leucogranites, biotite±amphibole granites, and potassic to ultrapotassic syenites/monzonites. The temporal variation in the nature of magmatism (calc-alkalic - high-K calc-alkalic/shoshonitic – peraluminous/ultrapotassic) contrasts with the cases of both the Himalayan and Alpine chains. In the first, calc-alkalic magmatism predated emplacement of two-mica leucogranites and high-K calc-alkalic to shoshonitic suites; in the latter, high-K calc-alkalic to ultrapotassic magmatism predated medium-K calc-alkalic magmatism and formation of crustal melts. This observation reinforces the view that the composition of igneous rocks cannot be used either as a proxy for any particular stage in the orogenic evolution, or to fingerprint specific geodynamic environments. On the other hand, combined structural and geochronological work provides important constraints on the timing and kinematics of regional deformation. In the present case, this helped to solve a longstanding debate concerning the age of development of the regional flat-lying foliation, which can no longer be attributed to Paleoproterozoic or early Neoproterozoic events, as proposed by several workers. It also allowed to connect the intrusion of 590-580 Ma-old plutons to a change from a low-angle, probably thrust-related, tectonic event to transpressive deformation.