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Domino structures as a local accommodation process in heterogeneous shear zones

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Usually, deformation in rocks is heterogeneously distributed, concentrating on planar zones located between rigid blocks, named shear zones. The geometry and kinematic criteria analysis becomes essential to understand the shear zones dynamics; the dominoes are one of the structures which can be used as a shear kinematic criteria. However, for the application of these structures as kinematic criteria, it is necessary a careful analysis of the tectonic environment associated with these structures.

These structures are developed under ductile-brittle to brittle regimes associated to a non-coaxial deformation and obeying Coulomb criterion for failure (Jaeger & Cook, 1981). Dominoes are characterized by the clear predominance of one shear family, that induces the block rotation during the deformation process. These structures are commonly associated to extensive regimes and in strike-slip environments their development is poorly known. In such non coaxial wrench domains, these structures are frequently interpreted as asymmetric boudins at mesoscale.

Current work, in Abrantes region (Central Portugal), emphasizes the presence of two major Variscan deformation phases. The second one (D_2) is associated with a NW-SE right-lateral non-coaxial shear component; This deformation increase to West, when approaching the Porto-Tomar-Ferreira do Alentejo shear zone, which leads to consider that this dextral first order shear was responsible by D_2. The D_2 structures are mostly right-lateral shear zones, developed at all scales, affecting clearly the first deformation phase structures. The D2 structures present a heterogeneous development with simple shear dominated transpression domains, alternating with domains that exposing pure shear dominated transpression. Locally, in simple shear dominated transpression domains, it is possible to see a complex S-fabric, characterized by the presence of several families of planar strucures, which accommodates the internal shear zone stress. This fabric is constrained to decimetric layer with well-defined borders and extensively laminated. It's possible to separate four families of planar structures given our geometry and kinematics: (1) main shear represents NNW-SSE right-lateral kinematics, parallel to the previous anisotropy (S_1). This shear acts like a rigid barrier and the other families don't cut this shear. (2) Shear family 1 are conjugate NNE-SSW to N-S left-lateral shears. Near the main shear the shear orientation is variable. (3) Shear family 2 are NE-SW to E-W left lateral shears, delimiting centimetric to milimetric blocks. This blocks exhibits rotation. It is possible to show more than one generation of shears. (4) Shear family 3 are NNE−SSW shears, with main shear synthetic kinematics. These family behave as c'-bands and have a punctual development.

Associated with this S-tectonite, appears cohesive fault rocks (cataclasite; e.g. Sibson, 1977). Cataclasite is characterized by distributed fracture and grain size reduction throughout shears. Therefore the blocks have rigid rotation in a plastic matrix (cataclasite); this heterogeneous flow accommodates the overlaps and gaps creation due the shear zones activity. The cataclastic flow is located near the main shear and shear family 1, yielding a crush zone. The field data shows that the domino spinning is result from dual acting between main shear and family 1 shear.

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