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Kinematically- versus dynamically-induced brittle deformations: the Chinese box ambiguity and solution. Application to the Antarctica Cenozoic Tectonics

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Brittle deformation (e.g. fault) populations collected in the field often show complex distributions and their geometry cannot be fully framed into a unique or a simple succession of paleo-stress episodes. This complexity results from the overlapping of local stresses and stress field distortion produced by the development and/or the presence of brittle surfaces and is responsible of a wide variety of secondary deformations (i.e. Riedel fractures). The grouping and ordering of the measured deformations based on the relative relationships allow to properly frame them into a reliable paleo-stress distribution. On the other hand, the limited surface of observation in the outcrops often prevent from the complete understanding of the relations among the found deformations. One way to solve this limitation is to group them by including into figurative scaled boxes of a given size and studying the relation between the given box and the outer tectonic environment. Two classes derive from this method: dynamic versus kinematic related deformations. The former group the deformations that can be explained as the effect of an outer stress field acting through the surface of the box. A conjugate set of faults framed into a box is an easy example. The second family (kinematic-related) is less obvious and includes any deformation set produced by the change in shape of the given figurative box. A classical transform fault, as well as tear faults, represent good example of this family. Of course these two classes constitute only end members and mixed deformations may develop. The hierarchy of the measured population is then obtained by the various dimensions of the boxes (the larger including the smaller as in Chinese boxes). This methodology was successful tested in the strike-slip dominated Cenozoic fault network developed in the Ross Sea Region of Antarctica.