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Flex – rigid behavior of quartzite and its mineralogical, microstructural and textural properties from EBSD

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It was investigated the mechanical properties of the quartzite found in the 'Moeda' Formation from the mineral province of the 'Quadrilátero Ferrífero', Brazil. Rocks with variations from flexible (in some portions) to completely rigid are rare and found only in some specific locations in the whole world. It's flexibility has been usually related to the presence of minerals with tabular habit, that act as structural support to the rock and regulates the flexibility. Besides, the intrinsic behavior of this type of rock is marked by their microstructures and the typical preferred crystallographic orientations. In order to characterize the causes of this unique mechanical property, oriented sections of these rocks with different behaviors, flexible and stiff, were prepared and investigated with EBSD. The results showed differences in grain sizes (with grain area as proxy) and grain boundary lengths for quartz grains, the spatial distribution of muscovite, as well as crystallographic fabrics. The boundaries of the quartz grains observed in the stiff sample are linear, while in the flexible sample they're irregular. Quartz grains with sizes smaller than 30 μm2 are 30% larger in the flexible quartzite than those of the rigid counterparts.. This relation reverses for grains with an area greater than 30,000 μm2. Muscovite occurs as isolated grains in the rigid samples while in the flexible ones grains more continuously distributed and interconnected.. When the directions of the samples are plotted in the crystal reference system a contrasting crystallographic texture arises. The X-directions of the sample concentrate in the <a> axes of the quartz. For the rigid samples it is te Y-directions that show preference to align parallel to the poles of the positive rhomb ({01-12} = this is the acute rhomb; rhomb is {01-11]). The rigid quartzite showed a strong <21 [U+0305]1 [U+0305]0> (<a>) crystallographic fabric parallel to the macroscopic lineation, whereas for the flexible ones the poles to the positive rhomb ({011 [U+0305]2}) showed the strongest crystallographic preferred orientation parallel to the Y axis of the strain ellipsoid. Both types of quartzites show similar pole figures for the main crystallographic directions. The texture intensity dysplayed by both may reflect the operation of the deformation mechanisms which would account for the constrasting mechanical behaviour of the two types.