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## Shear zone development and structurally-controlled skarn ore mineralization in the Rosas district, SW Sardinia.

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The Rosas Shear Zone (RSZ) is a 1 km thick brittle-ductile shear zone that outcrops in the Variscan fold and thrust belt foreland of SW Sardinia, where several important ore deposits were mined in the last century. The RSZ lies in the footwall and strikes parallel to the NE-dipping regional thrust that separates the Variscan foreland from the nappe zone. Two thrusts that developed along the limbs of two km-scale overturned antiforms, with NE-dipping axial plane, bound the RSZ. The folds show a SW-facing direction and a well-developed axial plane cleavage, and affect a lower Cambrian-upper Ordovician stratigraphic succession mainly made, from bottom to top, by a sequence about 200 m thick of dolostones and massive limestone followed by 50 m of marly limestones overlain by about 150 m of sandstones, pelites and siltstones, finally unconformable capped by conglomerates and siltstones, ranging in thickness from a few to 200 m. Differently, within the RSZ the bedding is completely transposed along the cleavage and its internal structure is characterized by anastomosing thrusts that affect the stratigraphic succession defining map-scale slices mainly consisting of dolostones and limestones embedded into the siliciclastic formations. It is noteworthy the occurrence of a NE-dipping, up to 100 m thick gabbro-dyke that postdates the deformation phases and that can be related to the exhumation of the chain during late Carboniferous-Permian times.

In the whole area, contact metamorphic and metasomatic processes selectively affected the Cambrian carbonate tectonic slices, originating several skarn-type orebodies. Mineralized rocks display the mineralogical assemblages and textures of Fe-Cu-Zn skarns, with relicts of anhydrous calcic phases related to the prograde metamorphic stage (garnet, clinopyroxene, wollastonite), frequently enclosed in a mass of hydrous silicates (actinolitic amphibole, epidote) and magnetite related to the retrograde metasomatic stage, in turn followed by chlorite, sulfides, quartz and calcite associated to the hydrothermal stage. Metasomatic reactions also involved mafic rocks, producing a mineral association marked by clinopyroxene, amphibole, epidote, prehnite and Ba-rich K-feldspar. Sulfide ores are made of prevailing sphalerite, chalcopyrite and galena, with abundant pyrite and pyrrhotite and minor tetrahedrite and Ag-sulfosalts. Garnets are andraditic/grossularitic, distinctly zoned and optically anisotropic. Field surveys pointed out the tight structural controls on skarn and ore formation. On a local scale, the gabbro emplacement along high- to low-angle NNW-SSE structures bordering the carbonate tectonic slices accentuate the effects of contact metamorphism, and metric to decametric mineralogical zonation

(garnet->pyroxene->wollastonite) are recognized. On a larger scale, extensive hydrothermal fluid circulations involved the structures of the RSZ. Infilling of metasomatic fluids in carbonate tectonic slices is fault-controlled and aided by the increase in permeability due to the alteration of prograde silicates. The causative intrusion related to skarn ores belongs to the early Permian ( $289\pm 1$  Ma) ilmenite-series, ferroan granite suite which intrudes the RSZ about 3 km east from the studied area. The Fe-Cu-Zn skarn ores of Rosas are best interpreted as distal, structurally-controlled orebodies, connected to large-scale circulation of granite-related fluids in the km-sized plumbing system represented by the RSZ.