Mineralogy and magnetic fabric of Triassic Red Beds from the Conraria Formation, Central Portugal

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The Conraria Formation is the lower unit of the 'Grupo de Silves' (Silves Sandstones Group) of Upper Triassic age. It is the sum of two subunits which have mean thickness of 40 ± 5 m and 120 ± 15 m, respectively, in the Coimbra region. The main goal of this study is to quantify the magnetic fabric of the upper subunit of the Conraria Formation and to relate it to the magnetic mineralogy. Studies of Anisotropy of Magnetic Susceptibility (AMS) were carried out on 50 samples from 11 sites in order to characterise the magnetic fabric. The magnetic susceptibility of these samples is comprised between 40.6 and 329.7 x 10^{-6} SI (average 170.36 x 10^{-6} SI). Magnetic anisotropy (described by the parameter $(k_{max}/k_{int}-1)x100$) ranges from 0.4 to 8.3 % (average 3.7%). AMS fabric shows consistent patterns in the studied sites: NW-SE-trending low dipping magnetic foliations associated with subhorizontal N197° trending magnetic lineations. The shape parameter is always oblate, exceptionally the sites where the magnetic susceptibility is higher (292.83 and 329.68 x 10^{-6} SI) have prolate AMS ellipsoids. Petrographic studies were performed in the samples with the lower and the higher magnetic susceptibility. In the first type, the main mineralogy is composed by quartz, feldspar, rock (lithic) fragments (quartzites and quartz-phyllites), muscovite, tourmaline and biotite. The cement is essentially sparry calcite with thin films of iron hidroxides coating the particles. The second type is composed by quartz, white mica, carbonates associated with specular hematite (needle-shaped crystals) and tourmaline. Feldspar are rare and rock fragments are absent. The cement is essentially ferruginous. Our results show that this formation retain a primary sedimentary fabric, related to a planar distribution of the paramagnetic phyllosilicates, with K_{min} closely perpendicular to the bedding plane. In this plane the magnetic lineation probably materializes the paleocurrents. The specular hematite associated with calcite is responsible for the prolate AMS ellipsoid. The general parallelism of the magnetic fabric with bedding indicates a composite fabric between a primary sedimentary fabric and an early tectonic layer parallel shortening fabric as it is attested by the magnetic anisotropy.

Weathering and hydrochemistry associated with the old mine workings at Fonte Santa (NE of Portugal)

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The quartz veins from the Fonte Santa mine consist of scheelite, pyrite, pyrrhotite, sphalerite, chalcopyrite, arsenopyrite, galena, iron oxides, Al, Fe and Pb hydrated phosphates and Fe sulphates. Scheelite has a homogeneous composition, but their fractures are filled with stolzite and ferritungstite. The area was mined for W between 1942 and 1982 and 2784 tonnes of tungsten were produced. Since then there has not been any development. Most waters from Fonte Santa are of mixed type, some are of Na-Mg and HCO_3^--SO_4^{2-} type. They are poorly mineralized. However, most parameters and element contents show an increase from outside to inside the mine influence due to the effect of abandoned old mining activities. There is no significant acid drainage associated with the old mine workings, which can mainly be attributed to the presence of calcium carbonates in country rocks that probably neutralized the waters and decreased metal concentrations. The most acid waters with the highest SO_4^{2-} and metal contents are from the mine lagoons, which received waters from fine-grained tailings and waste rock. The environmental impact of the Fonte Santa mine area is essentially related to a flooding event that carried a suspended contaminated load, increasing the Fe and Al contents in natural stream waters inside the mine influence. Most waters associated with the mineralized veins and old mine activities have Fe and Mn concentrations that forbid their uses for human consumption and agriculture. Some waters present concentrations above parametric Portuguese values for other contaminants (SO_4^{2-}, NO_2^-, Mg, Zn, Al, Ni and Co) and must not be used for human consumption. The alteration of albite, chlorite and muscovite from country rock is responsible for Na, Mg and K contents in the waters, whereas the weathering of carbonates and scheelite are probably the sources of Ca. The weathering of rock-forming minerals and ores caused the precipitation of secondary phases (halloysite, smectite, vermiculite, ferritungstite and Fe sulphates).