

Der historische Wolframbergbau in Arouca, Portugal
Geologie als Touristenmagnet in Arouca, Nordportugal

Historic tungsten mines from Arouca (Portugal)
Geology as a tourist highlight toward Arouca (north Portugal)

1. Historic tungsten mines from Arouca (Portugal)

During the first and second World Wars the need for tungsten has increased several times. The metal was need for cutting and wear resistant materials but also for armour plate and armour-piercing ordnance.

Portugal was one of the main producers of Europe both for the Allies and the Germans. The Panasqueira mine, still working on the centre of the country, and Borralha on the north, were the two main mines. The third area was Arouca, geographically between the two mentioned mines. There, two mining centres (namely Rio de Frades and Regoufe) produced the gross of the ore, although dozens of small mines were mining tungsten and tin in the mountings. All these mines have been intensively exploited between 1916 to about the end of the Korea War. During the World War II the Portuguese politicians were pressed by foreign governments in order to assure the W production from these mines, as both were considered important for political blocs.

The ores from Arouca consist of hydrothermal quartz veins averaging 0.25 m of thickness, with a simple paragenesis composed of wolframite + cassiterite + arsenopyrite as the main minerals, installed in an Hercynian granite (Regoufe) and pre-Ordovician schists (Rio de Frades). These two areas, which are separated by 5 km, have worked for the English and for the Germans, respectively. This mining was the first proletarian activity in the Arouca council and still remains as the most important industrial activity until now.

The care and maintenance of some galleries in each mining centres, coupled with pertinent information to the public (panels, brochures, web pages) is a necessary step in order to: 1- maintain the memory of the historical importance of these mines; 2- be places where ore geology and mine engineering could be learn in a practical way; 3- be places where citizens may learn aspects of the technical culture of the XX century and 4- constitute highlight sites in trails of active tourism already implemented in the areas.

2. Geology as a tourist highlight toward Arouca (north Portugal)

Arouca is a small village (around 3000 hab.) located 50 km SE of Porto and also a council of 327 km² of lands comprising of a plateau roughly 1000 m in height and a planar area about 200 m. The area is crossed by mountain rivers allowing the practice of water sports such us kayak, rafting and cannyoning. In the plateau there are excellent conditions for mountain cycling and paragliding. Six trails officialised by the Portuguese federation of camping allowing walks throughout the most interesting ecological parts of the region.

Arouca's main economic activity is agriculture and services. Industries are of small scale only with local importance. However it was not always like this.

Since 1916 to circa 1965 there was an important mining activity. Two mining centres (named *Regoufe* and *Rio de Frades*, after the homonymous small villages near by) and dozens of small mines exploited tungsten ore (plus minor tin ore) from vein quartz that crossed the schists or the granitic rock. Curiously, the two main mines, which were separated by 5 km, had been exploited by Germans (Rio de Frades) and by English (Regoufe). In the hard times around 1942 the ore exploited here was an issue of dispute between the

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Portuguese, German and English politician. Meanwhile those who were fortunate enough found good wolframite areas in the mountain becoming “rich” from the night to day. However most of them wasted this richest in a matter of days and thus became even poorer.

Unfortunately until now there hasn't been any geoconservative actions in these old mines and there is no adequate levels of safety inside the galleries. However, at Rio de Frades, one gallery is relatively safe and although presently I would not recommend the entry, I hope that the situation could change in the near future.

Another interesting fact belonging to the geological heritage of Arouca is the existence in a slate quarry of gigantic (up to 70 cm) species of trilobites (*Ectillaenus giganteus*, *Hungioides Boehmicus*, *Neseuretus avus*, *Nobiliasaphus delesse*, *Ogyginus fortleyi*, *Placoparia cambriensis*, *Retamaspis melendezi*, *Colpocoryphe thoralis conjugens*, among others- Sá & Valério, 2005). The fossils are Ordovician (lower Oretanian, around 465 My old). The Valerio slate quarry (after the name of the owner) from Canelas, located exactly 10 km by road from the administration building of the Arouca council (Câmara Municipal) has an extremely important paleontological record that must be studied, knowing and preserved. Due to the sageness of the owner the site has been subject to some geoconservation and a museum and a touring visit to the site is being finished.

The third and perhaps the most famous of the geological aspects of Arouca is the site knowing locally as “*pedras parideiras*”- that could be translated somewhat like *the giving birthrock*”. This geological rarity is a medium grained two-mica granite with a remarkable abundance of biotitic nodules. Due to thermoclastic weathering the nodules (each between 1 – 8 cm diameter) periodically come out of the granite and accumulate abundantly on the ground. The granite outcrops in an area of 600 x 1000 m, adjacent to the small village of Castanheira and although just 1 km from to the Serra da Freita granite it is surrounded only by the so-called Beira Schists. Studies on the petrology of this nodular granite (Reavy et al., 1993) suggest that this small Castanheira granite is a facies of the Serra da Freita pluton. The genesis of this rare igneous rock suggest that the rock is a diapirically mobilized halogen rich and low-viscosity facies dynamically rising in a buoyant bubble during the final consolidation of the underlying Serra da Freita pluton (REAVY et al., 1993). The emplacement was synkinematic into a major sinistral shear zone (REAVY, 1989).

This spot has been subject to geoconservation actions done by the administrative authorities.

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