Characterization of tungsten ores at the Santa Comba mine

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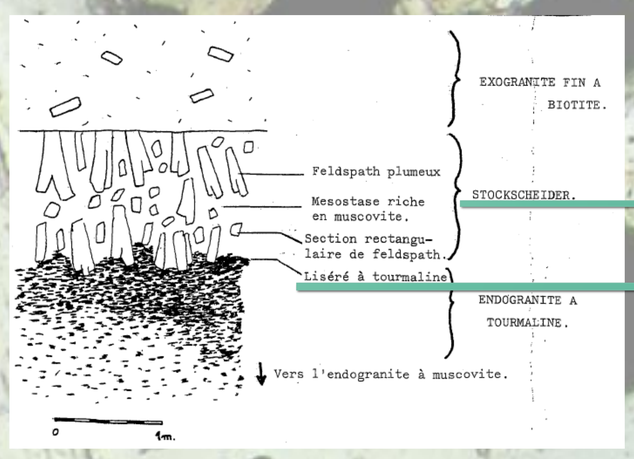
Introduction

The Santa Comba deposit is one of many W-Sn deposits related to peraluminous variscan granites in the NW of the Iberian peninsula. The mine is set in a poly-intrusive epizonal complex which fits the **Endogranite**-**Stockscheider**-**Exogranite** model. The deposit features two types of mineralization containing cassiterite (SnO_2), wolframite ($FeMnWO_3$), and scheelite ($CaWO_4$) one located in quartz veins and a disseminated one hosted in the endogranite.



The **Stockscheider** is a pegmatitic texture that shapes the exo-endogranite contact. Is caused by a sudden drop in water saturation

Geology of Santa Comba

The deposit is within the Iberian Massif, in the westernmost section of the Variscan Orogen. The intrusion is located in a pull-apart structure formed on a major N-S dextral shear zone. The complex is made up of 3 concentric intrusions and a quartz vein system. The intrusions can be divided in:

- **Exogranite**: The two outer intrusions. They are barren two-mica porphyritic granites differentiated by the more prominent mica. The outermost granite has a high biotite concentration, whereas in the inner unit muscovite is the more prominent mica.
- **Endogranite**: The youngest unit of the complex. It is a leucocratic equigranular granite that contains disseminated mineralization.

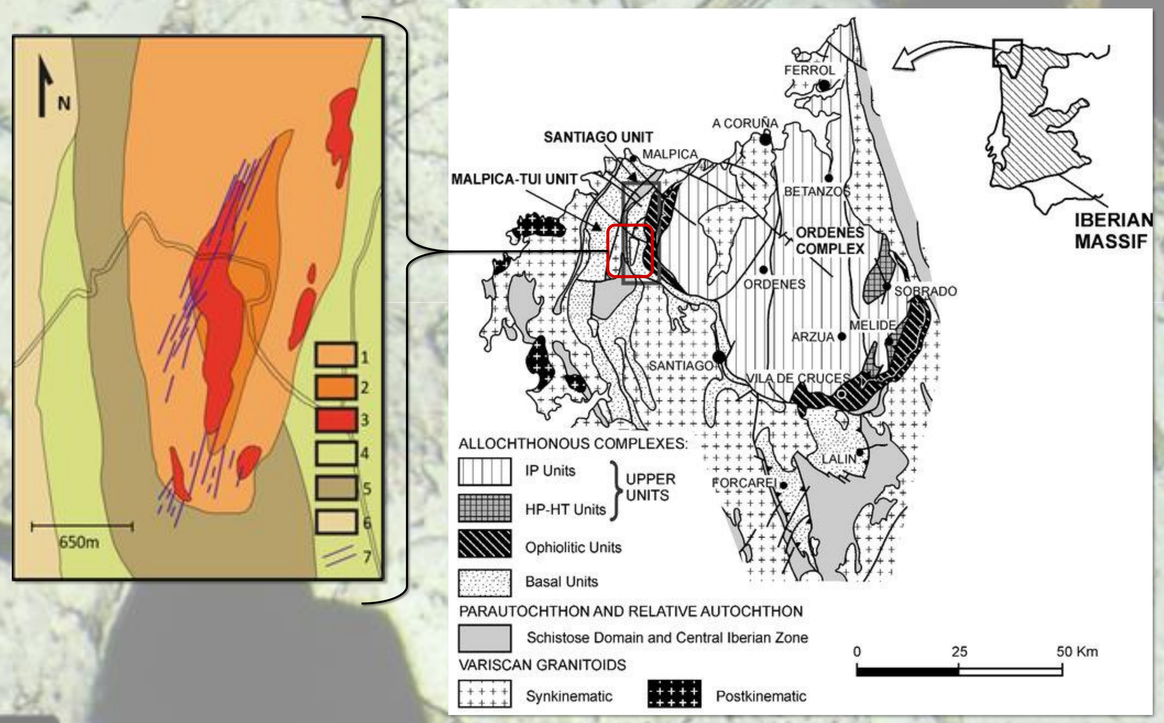


Fig 1: To the right: Modified map showing the geological context of the mine within the Ordenes Complex and within the Iberian Massif (modified from Rubio Pascual et al. 2002). To the left: Geological map of Santa Comba (modified from Borrajo et al. 2022). 1-2: exogranite; 3: endogranite; 4: Órdenes Complex; 5: orthogneisses; 6: schists; 7: quartz veins with Sn-W.

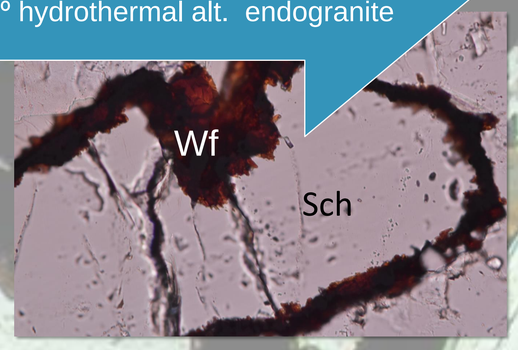
References

- Borrajo, I., Tornos, F., Boixet, L. (2022): Porphyry-like magmatic-hydrothermal W-(Sn) mineralization: Fontao and Santa Comba deposits (northwestern Spain). 22nd Biennial SGA Meeting Abstract volume.
- Rubio Pascual, F., Arenas, R., García, F., Catalán, J.R., Abati, J. (2002). Contrasting high-pressure metabasites from the Santiago unit (Ordenes Complex, northwestern Iberian Massif, Spain). Special Paper of the Geological Society of America. 364, 105-124. 10.1130/0-8137-2364-7.105.

Discussion & Results

Vein Mineralization
- High-grade
- Low Tonnage
- Most sch II & wf II
- Late qz veins with sulfides

Disseminated Mineralization
- Low-grade
- High tonnage
- Sch I & wf I
- ↑T° hydrothermal alt. endogranite



Petrographic characteristics

- **Wf I**: large-sized deformed crystals abundant in the tourmaline-rich facies.
- **Wf II**: variable grain size, often appears in veins with cassiterite and sulfides or as rims surrounding sch I.
- **Sch I**: deformed grains with undulant extinction, fractures, and at least two FIAs
- **Sch II**: large, anhedral crystals with no show signs of deformation appears mostly in veins with sulfides.

Compositional characteristics

Element	Nb2O5	FeO	MnO	MoO3	Ta2O5	WO3	Total
21	0.14	14.40	10.59	0.07	0.07	74.23	99.52
22	0.05	12.79	12.12	0.06	0.00	74.28	99.34

Element	Wf I	Wf II	Sch I	Sch II
FeO	13.34	8.29	0.02	0.17
MnO	11.77	16.13	0.00	0.15
CaO	0.02	0.15	21.09	21.27
Nb_2O_5	0.77	0.02	0.02	0.00
MoO_3	0.07	0.03	0.00	0.05
Ta_2O_5	0.16	0.00	0.00	0.05
WO_3	72.89	74.01	77.98	78.09
Total	99.03	98.64	99.11	99.79

Table 1: Punctual EPMA analysis in wolframite with wf II growing over wf I
Table 2: Average EPMA results for the different tungsten ores in Santa Comba

- **Wf I**→ Fe-rich, has a H/F (Hubnerite/Ferberite) ratio of ca. 52 Nb-Ta rich
- **Wf II**→ has a high Mn concentration, H/F= 63 Nb-Ta poor
- **Sch I**→ Low Fe-Mn
- **Sch II**→ High Fe-Mn

Conclusions

- In Santa Comba, there are at least two tungsten mineralization events.
- Scheelite can be the early phase to precipitate
- The difference in the compositions of wf I and wf II can be interpreted as an increase in the Mn/Fe ratio of the fluid during the later stages of the magmatic-hydrothermal evolution

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