Paper Number: 3779

Textural characteristics of sulphides associated with gold mineralization at the Barberton mines, Barberton greenstone belt, South Africa.

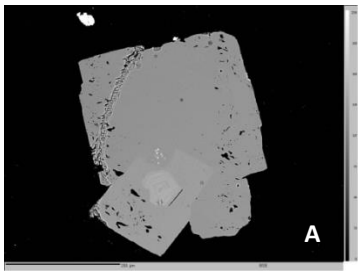
Altigani, M.A.H.[1], Merkle, R.K.W[1], and Hammond, N.Q.[2]

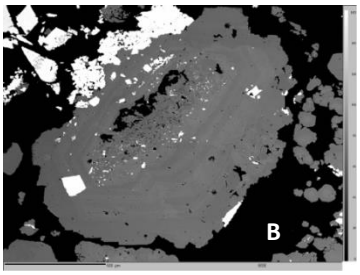
[1]Department of Geology, University of Pretoria, Pretoria, South Africa, 0002, (m.alnagashi@gmail.com).
[2] School of Physical and Mineral Sciences, University of Limpopo, Polokwane, Limpopo, South Africa.

The Barberton greenstone belt (BGB) of the Kaapvaal Craton, South Africa is one of the oldest granite-greenstone belts in the world, and one of the most studied Archaean greenstone belts worldwide. It is also considered as one of the most important gold producing terrains in the Republic of South Africa, with gold production starting in the late 19th century. More than 85% of the gold produced between 1886 and 1995 in Barberton came from the Sheba, Fairview and New Consort mines. These three mines have a continued production of ~ 2.9 ton of gold annually.

The main sulphides associated with gold mineralization in these mines are pyrite, arsenopyrite, pyrrhotite, chalcopyrite, Ni-rich arsenides, and sphalerite. The textural relationship, mineral chemistry and morphology of these sulphides provides evidence that mineralization is associated with two main stages/generations, an early phase and a later phase. The first generation of sulphides is characterised by anhedral and porous pyrite and pyrrhotites, anhedral chalcopyrite, anhedral and elongated arsenopyrites). Sulphides associated with this episode also show much heterogeneity, zoning, replacement textures, contain gold inclusions, and significant enrichment in trace elements values particularly Ni and Co. Earlier sulphide phases commonly occur in the core of the grains, while the relatively younger phases surround the earlier phases or as separate grains from the older phases. In most cases the cores of these sulphides are chemically different compared to their rims, which thus suggest different mineralizing fluids with varied composition. Also, the earlier sulphide phases commonly exhibit oscillatory or concentric zoning patterns (Fig A, B, and C) which may be attributed episodic flow of hydrothermal fluid during mineralization or a disequilibrium between growing mineral and adjacent fluid during crystallization [1].

The later generation consists of euhedral grains of pyrite, arsenopyrite, pyrrhotite, and subhedral chalcopyrite. Recrystallization is a common feature within this generation of sulphides, no gold inclusions are observed in these sulphides. Distinct deformational features of ore-minerals observed from the three studied gold mines (Sheba, New Consort, and Fairview) are: recrystallization (porphyroblastic) and cataclastic textures. These textures of sulphide minerals from Sheba, New Consort, and Fairview gold mines are indicative for a long history of tectonism, and reflects at least two successive hydrothermal fluid events and mineralization stages.





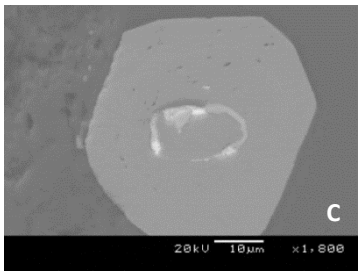


Figure 1: Backscattered images show: A: concentric zones rich in arsenic located between two grains of pyrite type 2, the small light-colour inclusions are arsenopyrite type 2. B: growth banding between pyrite type 1 and arsenopyrite type 1, the oscillatory zones reflect As-rich inside the pyrite type 1 (cores), which are not common to see between pyrite type 2 (rims). C: circular growing bands of pyrrhotite and As-rich domain inside early stage pyrite type 1.

Reference:

[1] Hammond NQ and Tabata H (1997) Mineralogical Magazine 61: 879-894