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Petro-structural and metallogenic study of the Segala deposit, Kedougou-Kenieba Inlier (KKI), western Mali.

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1. Introduction

The Segala gold deposit is located in the West Malian Gold Belt within the Paleoproterozoic Kedougou-Kenieba Inlier (KKI). It is hosted within the Birimian metasediments of the Kofi Series, near the Yatia granite. Segala exhibits a complex petro-structural and metallogenic evolution marked by successive intrusions of magmatic dykes and hydrothermal episodes associated with phases of regional deformation. In contrast to the dominant regional N-S to NNE-SSW orientation, the mineralization follows an E-W trend, suggesting local structural control.

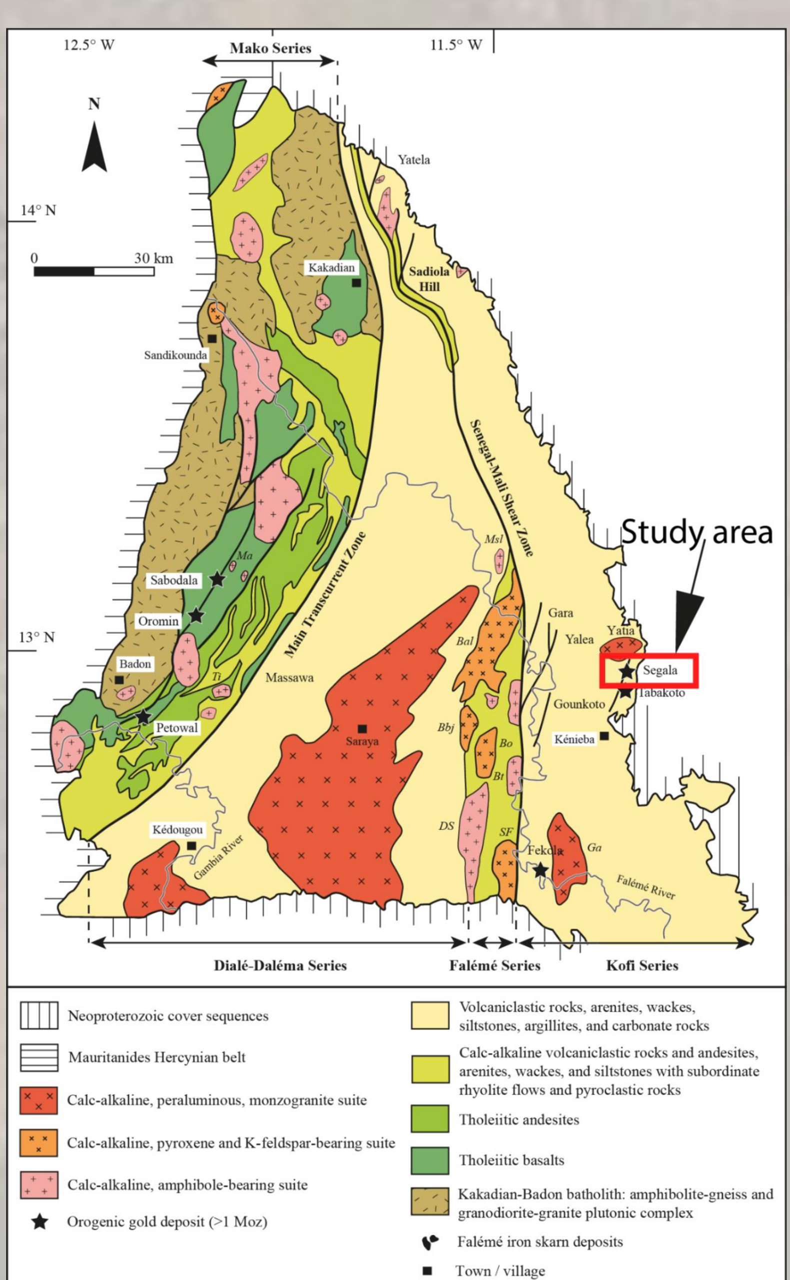

Figure 1: Location of the study area on the geological map of KKI

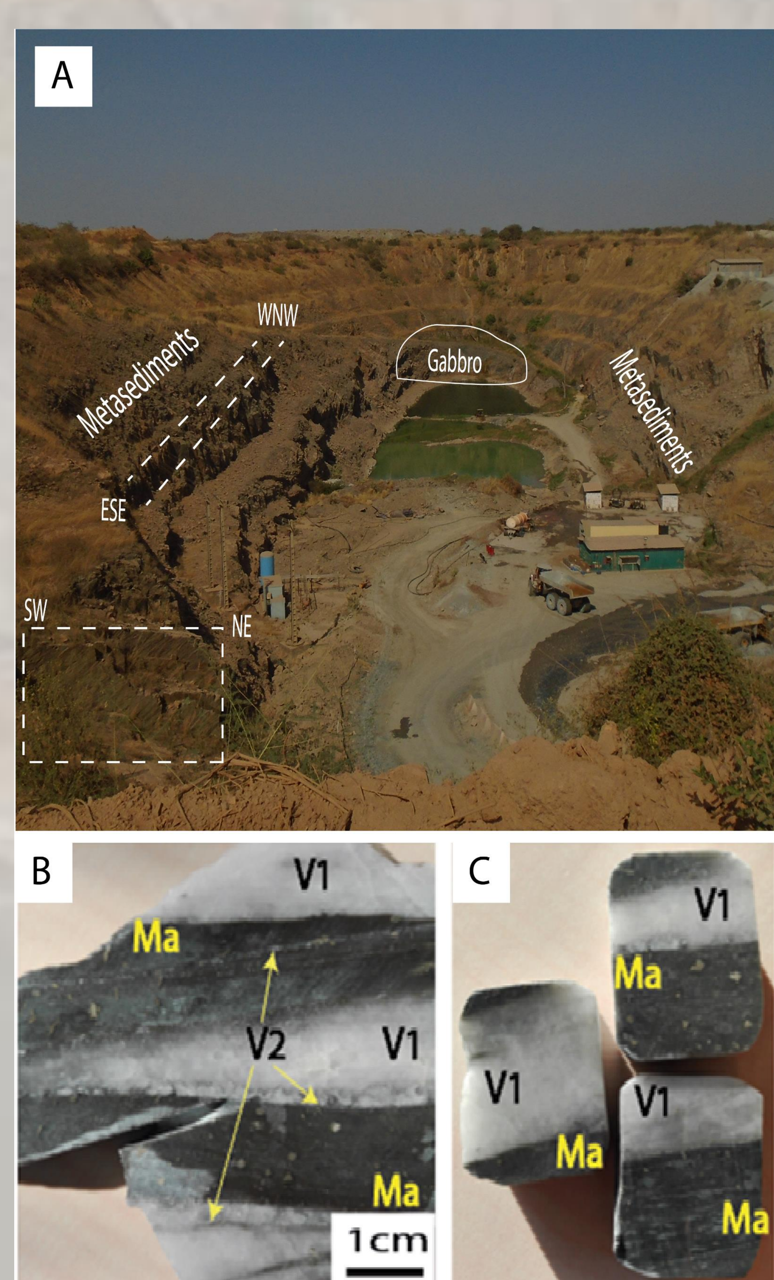

Figure 2: A) Overview of the Segala deposit pit, where the metasediments are oriented WNW-ESE with a gabbroic intrusion at the end of the deposit. The deposit are cross-cut by several NE-SW-trending faults. B and C) The host rock (claystone) cut by two generations of veins (V1 and V2).

2. Petrographic characterization

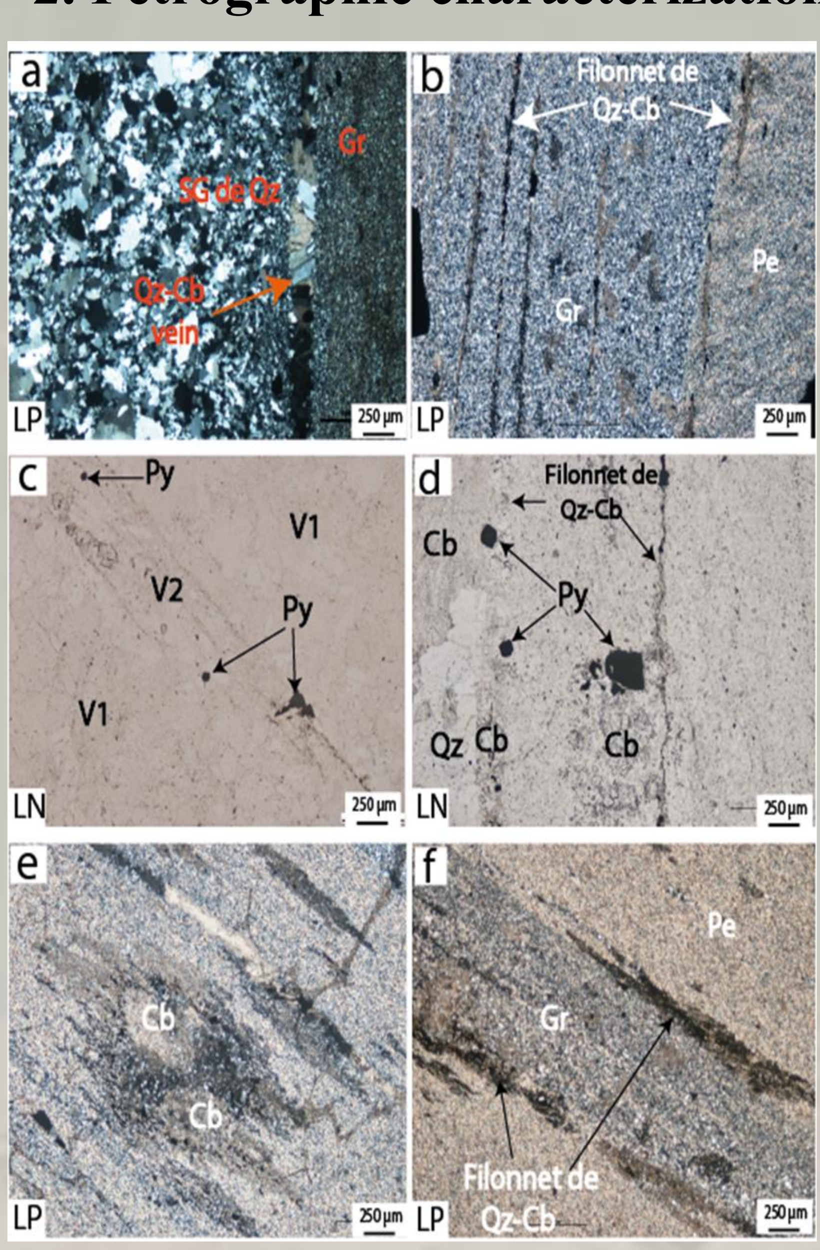

Figure 3: a: V2 intruded into the claystone near V1; b: Qz-Cb veinlets cutting through the claystones and grauwackes; c: V2 (quartz) cutting through V1 (quartz-carbonate); d, e, and f: Quartz-carbonate vein in the claystone associated with sulfidation. Abbreviations: LP: polarized light; LN: natural light; Gr: sandstone matrix; Pe: pelitic matrix; Qz-Cb: quartz-carbonate; Cb: carbonate; V1: type 1 vein; V2: type 2 vein; Py: pyrite.

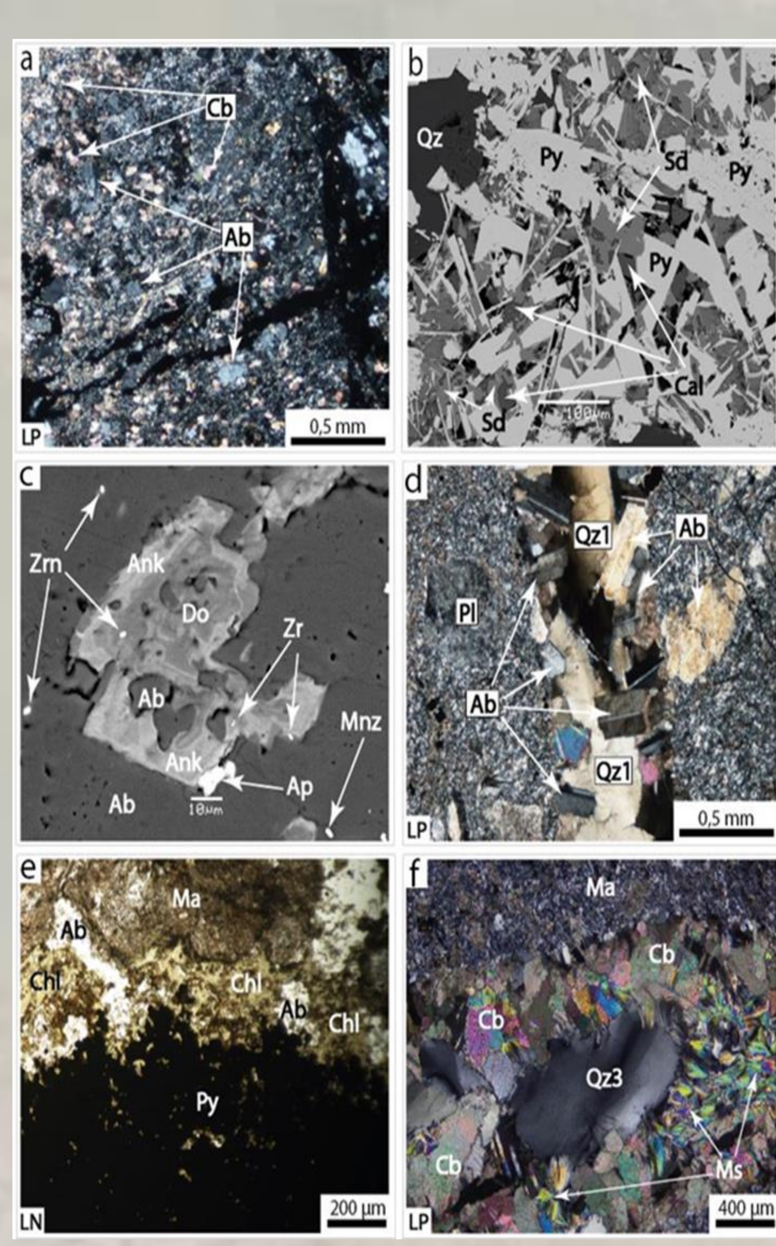

Figure 4: Photomicrographs showing: a) carbonate alteration of the matrix; b) an association of siderite and calcite with pyrite 2; c) replacement of dolomite by ankerite with inclusions of albite, zircon, and apatite; d) a quartz-albite vein; e) a hydrothermal alteration zone with chlorite associated with pyrite; f) late-stage muscovite rosettes on the carbonate vein.

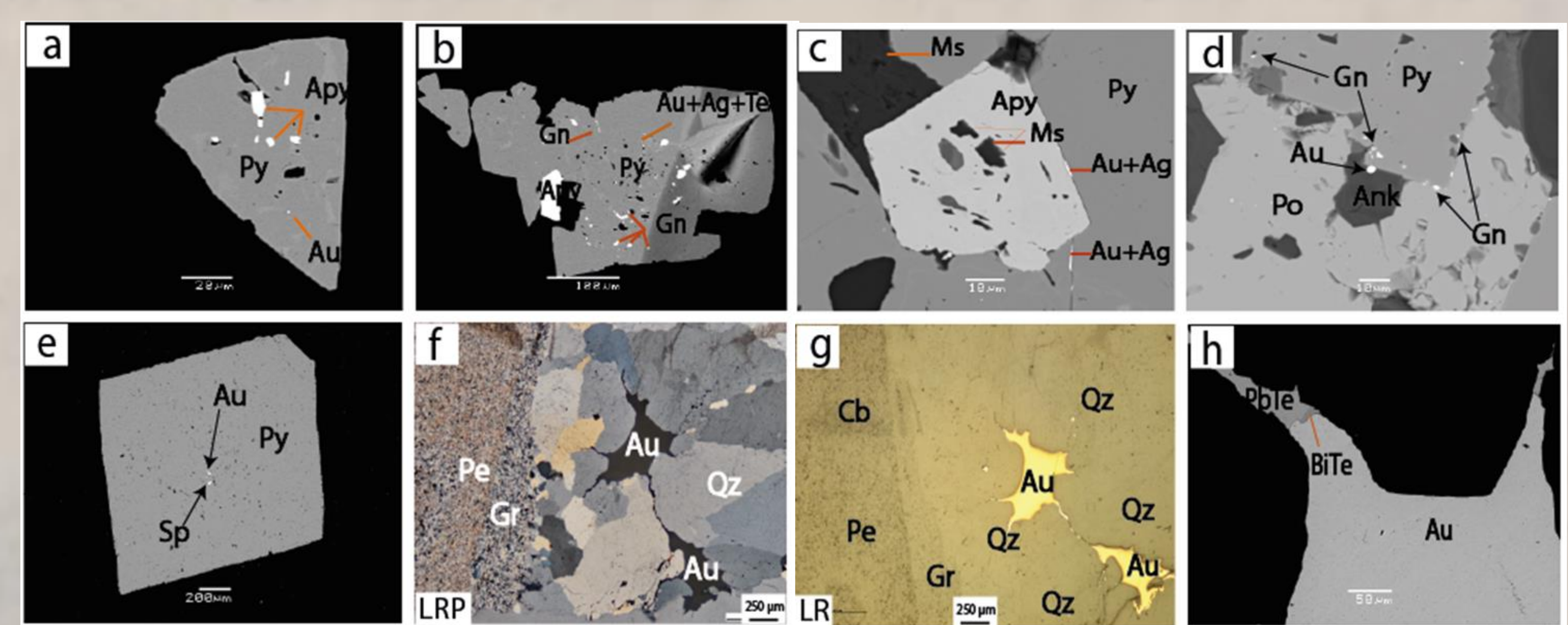

Figure 5: Paragenesis of gold mineralization. a and b: Type 1 gold as an inclusion in pyrite; c and d: Type 3 gold remobilized in fractures and at the contacts of pyrite; e: Type 2 gold as an inclusion in Type 2 pyrite; f, g, and f: Type 1 gold in quartz vein 1 without other sulfides. Abbreviations: LR: reflected light; LRP: polarized reflected light; Py: pyrite; Apy: arsenopyrite; Po: pyrrhotite; Au: gold; Ag: silver; Te: tellurium; Bi: bismuth; Ms: muscovite; Gn: galena; Ank: ankerite; Sp: sphalerite; Cb: carbonate; Qz: quartz; Gr: sandstone matrix; Pe: pelitic matrix.

3. Structural features

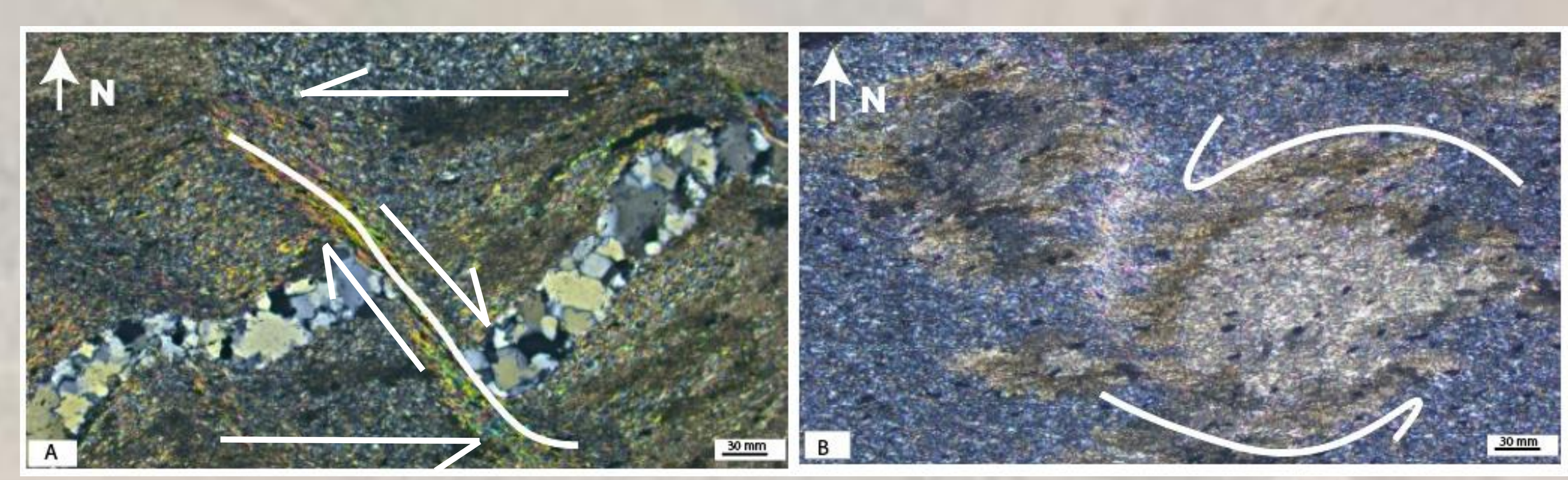

Figure 6: Photomicrographs illustrating: a) a ductile shear zone with sinistral kinematics, associated with asymmetrically folded quartz veins. Progressive deformation reached the mylonitic stage, characterized by the development of a mylonitic fabric. The main WNW–ESE-trending sinistral shear zone is cross-cut by a second NW–SE dextral shear plane; **b)** a penetrative foliation defined by the preferred orientation of phyllitic minerals (chloritized biotite, muscovite and chlorite).

4. Results and Synthesis

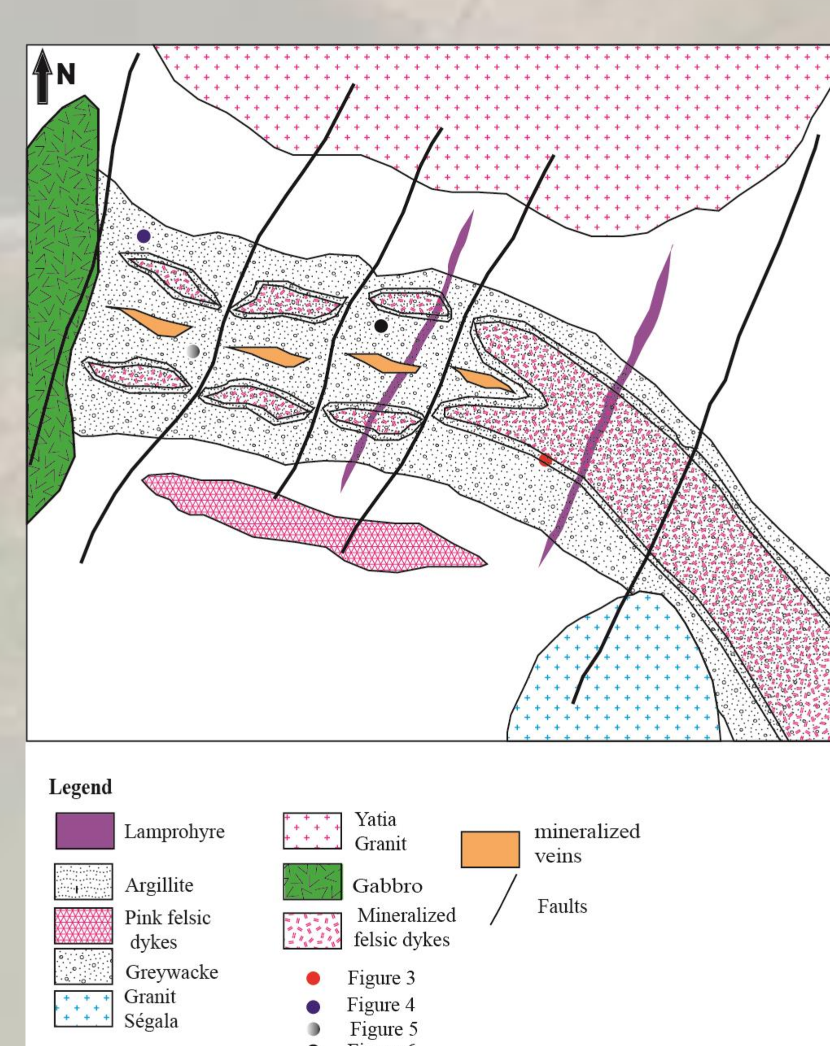

Figure 7: Litho-structural map of the Segala gold deposit (Not to scale)

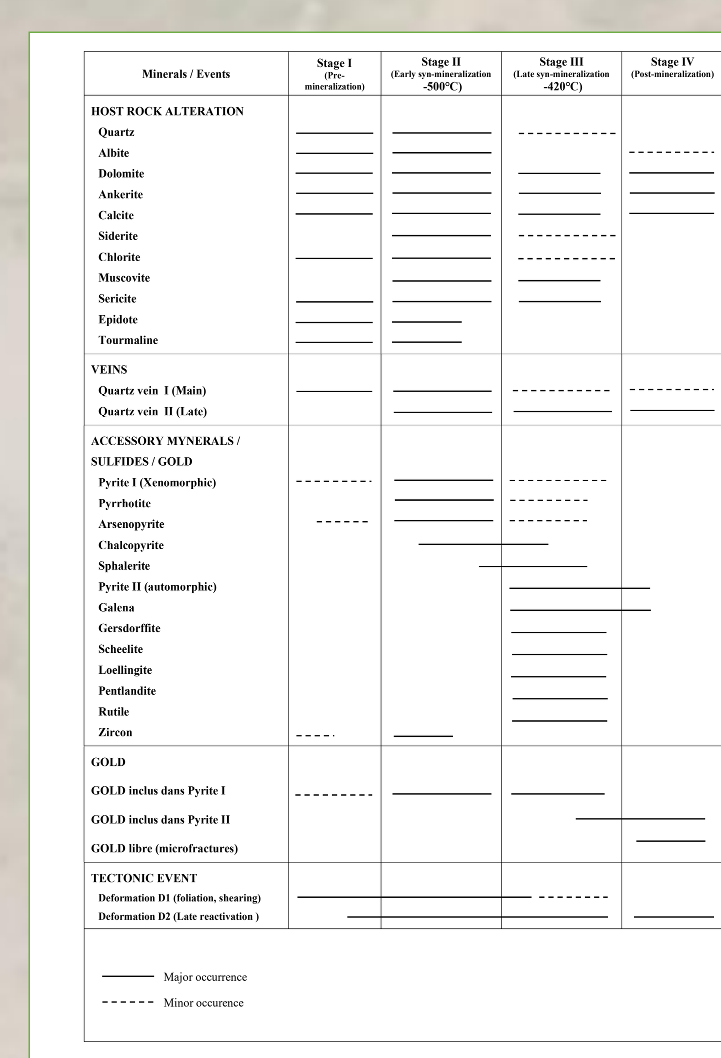

Figure 8: Summary of the various stages of mineralization with associated mineral assemblages.

5. Conclusion

The Segala deposit represents an orogenic gold system controlled by the interaction betwen host lithologie, deformation structure and hydrothermal fluids. Gold mineralisation is associeted withe quartz and quart- carbonate veins and a sulfide assemblage dominated by pyrite. This study highlights the major role of shear zones in fluid circulation and gold concentration.

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