

Structural geology of the Timiskaming and Cadillac groups along the Malartic segment of the Larder Lake–Cadillac deformation zone and implications for gold mineralization, Abitibi greenstone belt, northwestern Québec

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INTRODUCTION

The Malartic segment is a NW-trending section of the overall E-trending Larder Lake–Cadillac deformation zone (LLCDZ; Figure 1a). This study documents three deformation events which affect the supracrustal rocks found adjacent to this segment of the LLCDZ. These supracrustal rocks include turbidites with local iron formations and conglomerates of the Cadillac Group and polymictic conglomerates, sandstones and argillites of the Timiskaming Group (Figure 1b).

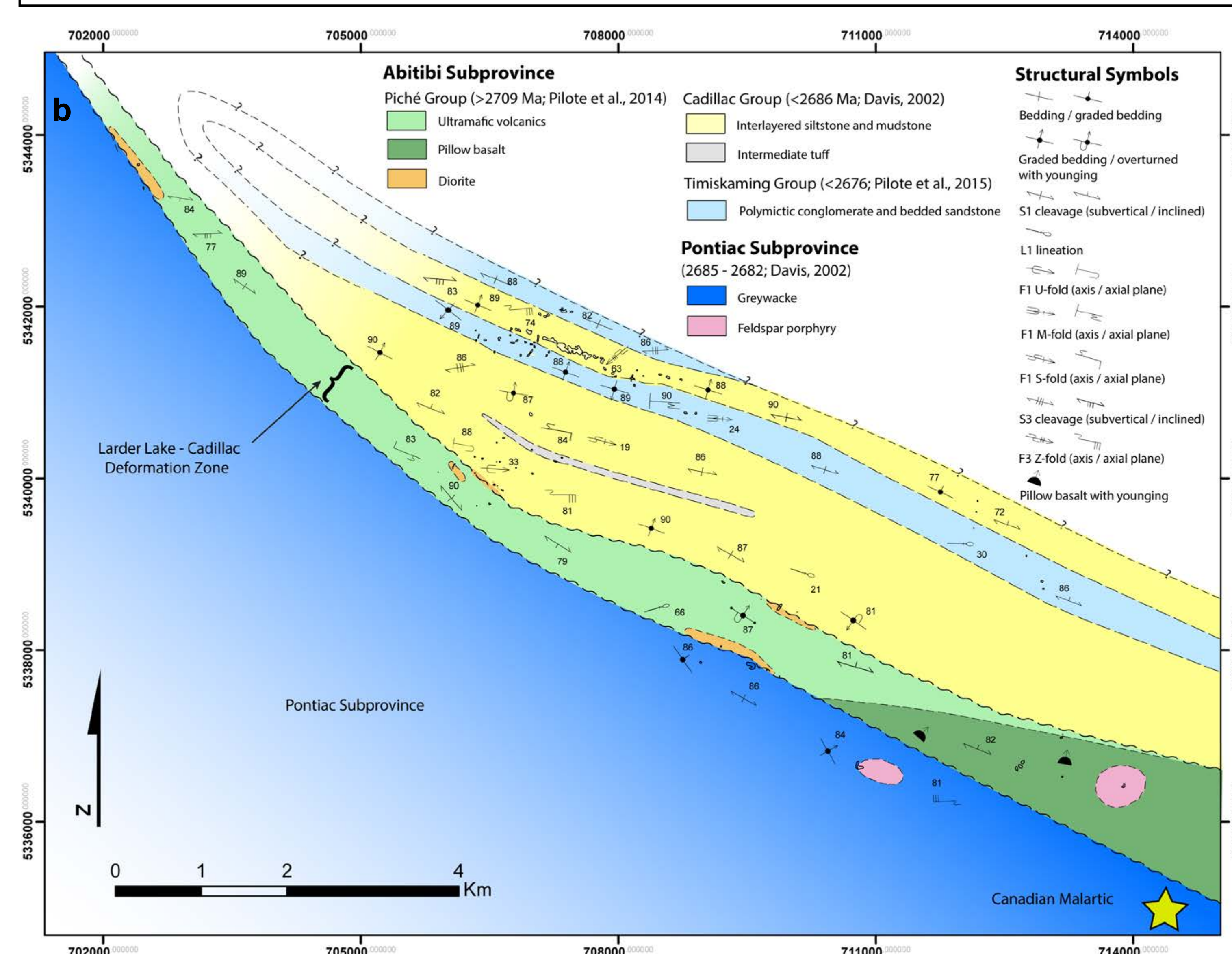
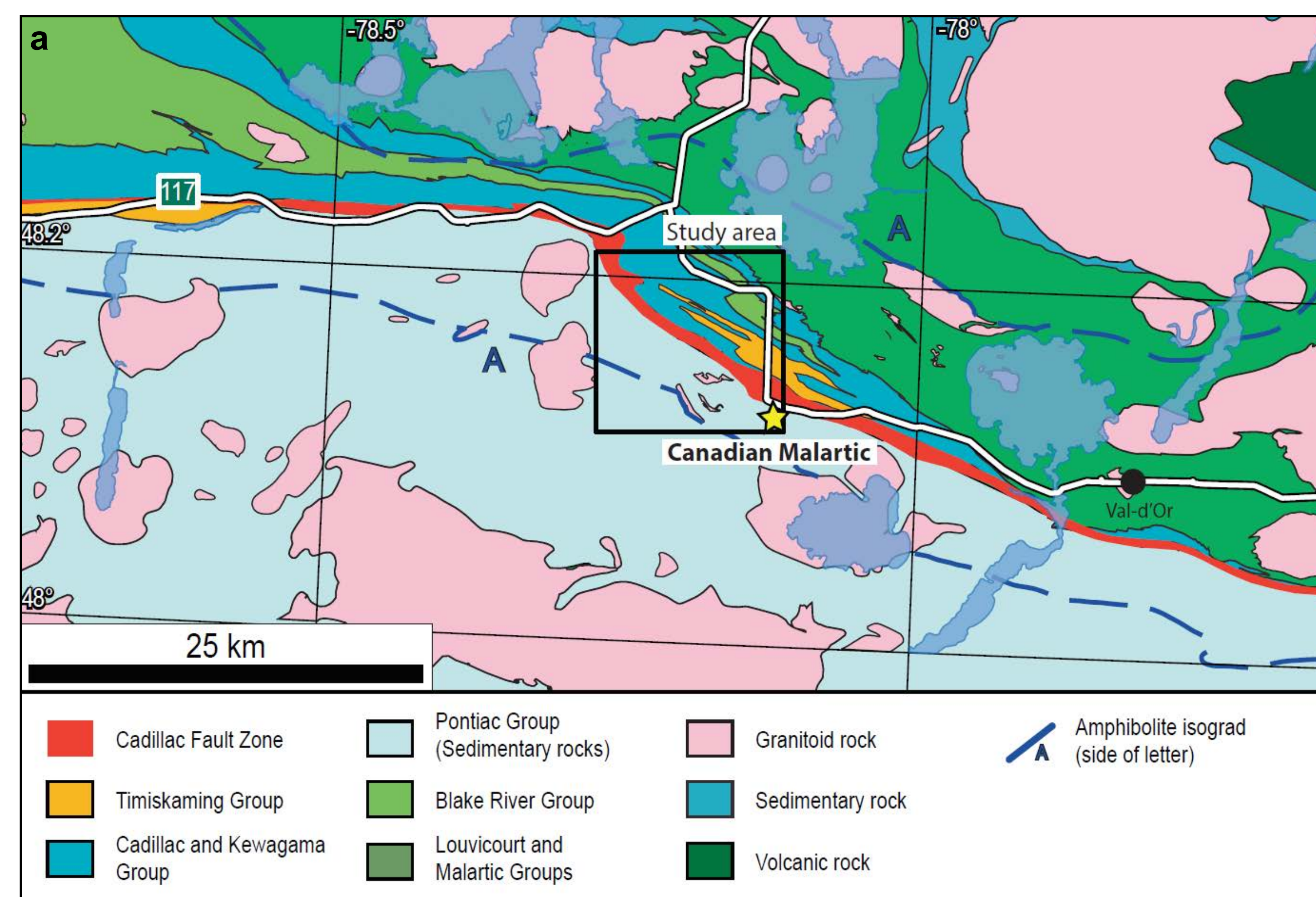
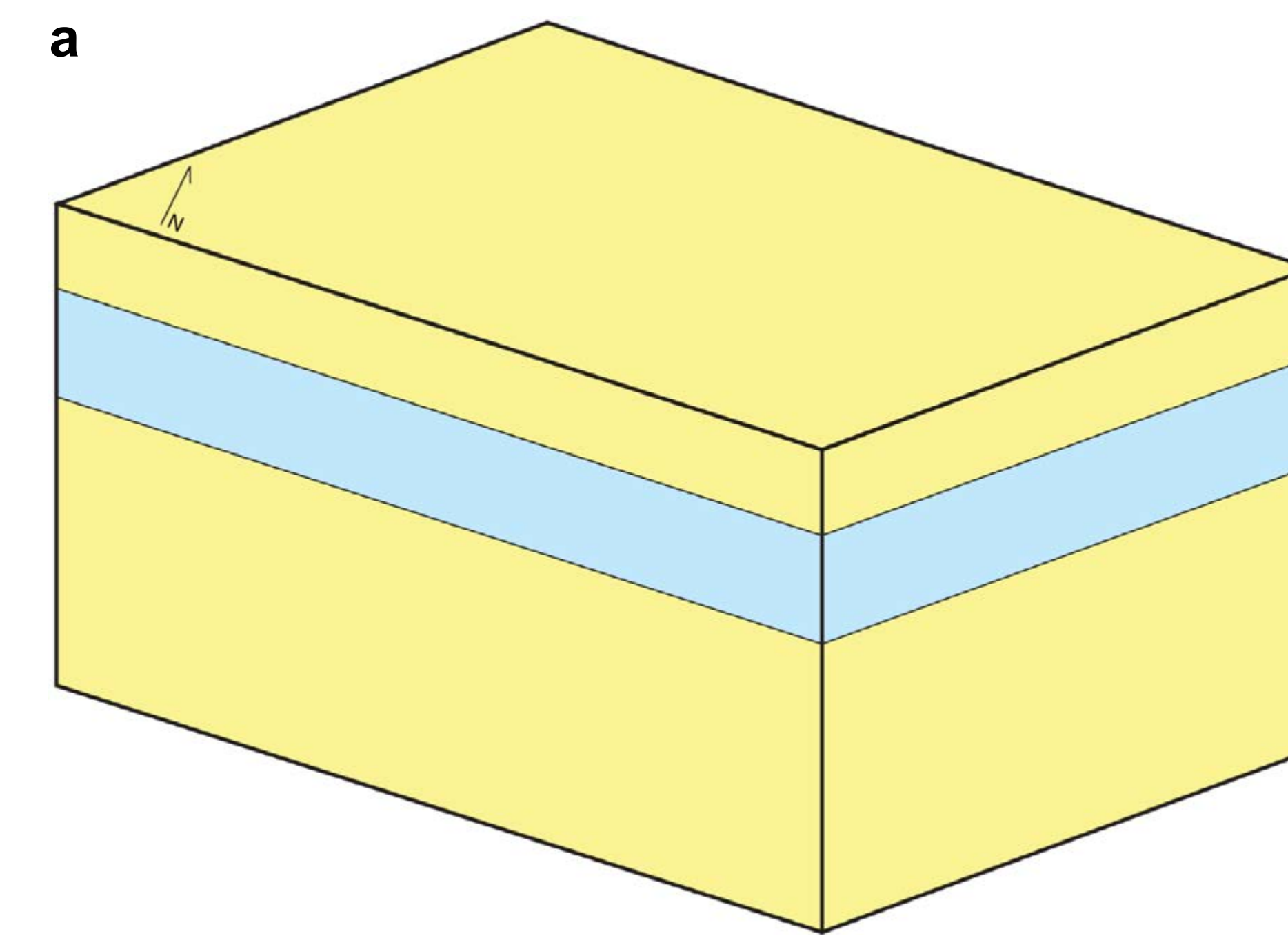


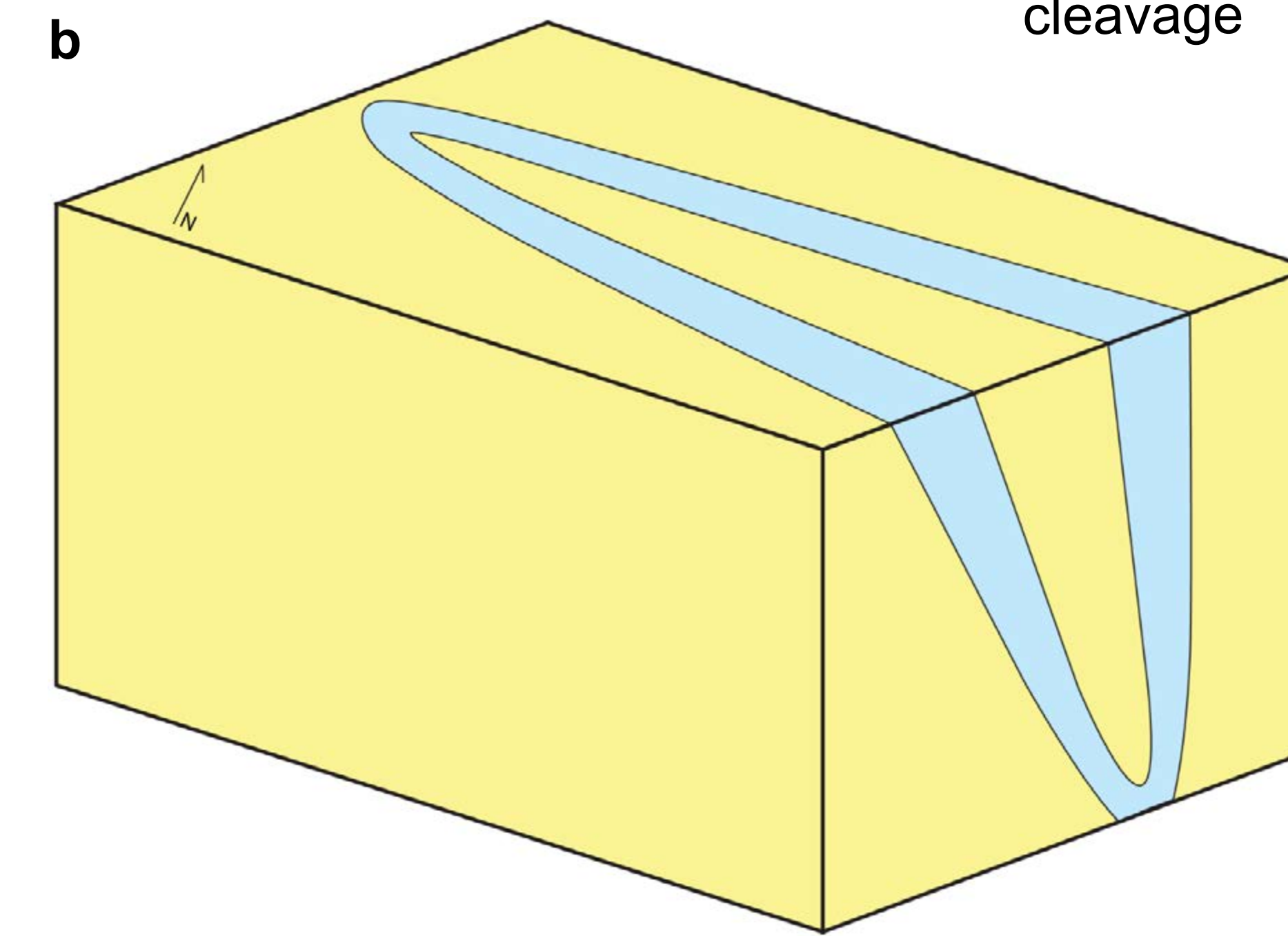
Figure 1: a) Regional geological map of the LLCDZ in the Malartic area. The area of focus for this study is outlined by the black box. Modified after Bedeaux et al. (2017). b) Simplified geological map of the study area. Modified after SIGÉOM interactive map (2017).

STRUCTURAL INTERPRETATIONS

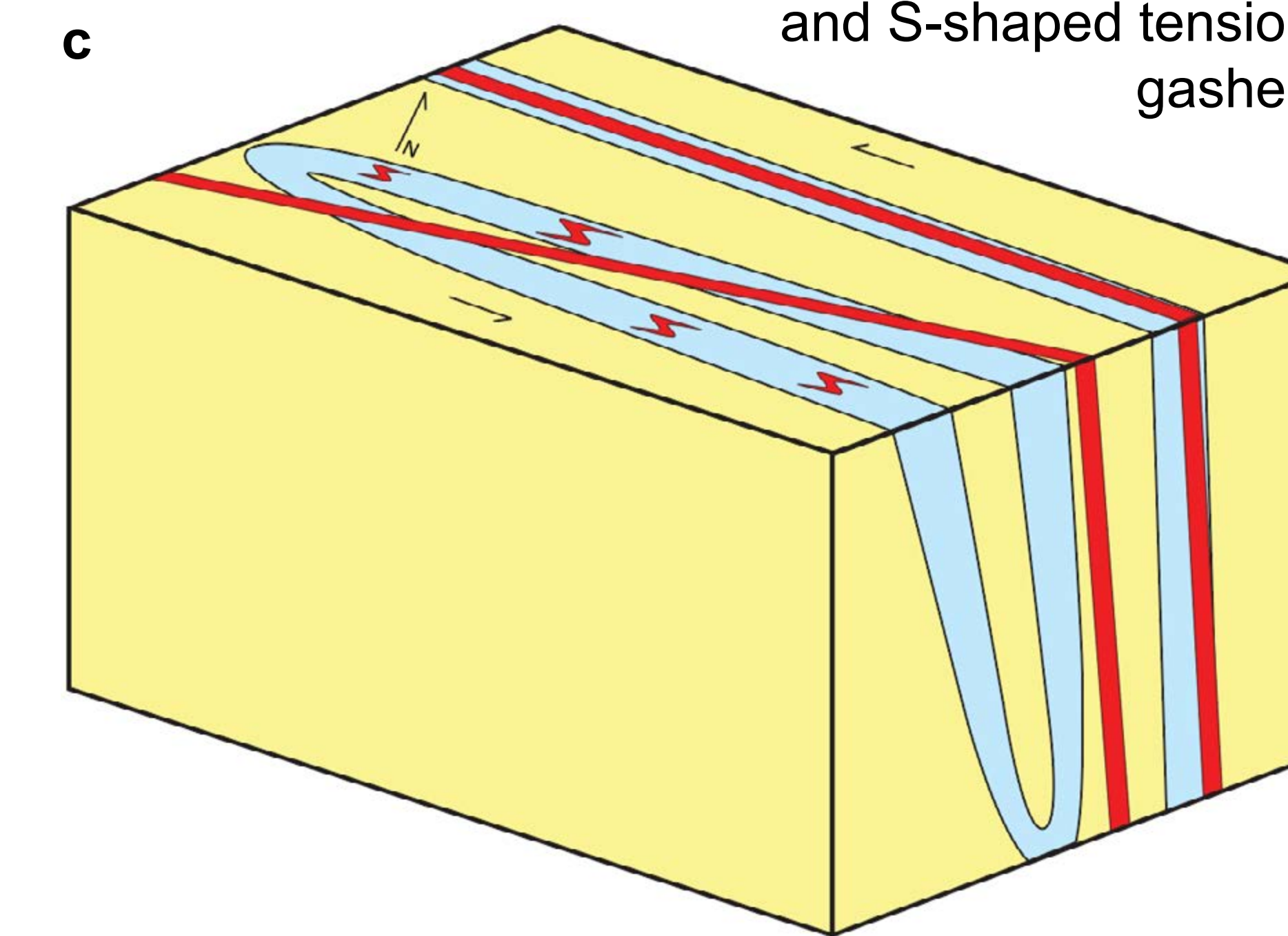
Original stratigraphy: Horizontal bedding



Regional folding: F₁ folds with an axial planar S₁ cleavage



Sinistral movement: Emplacement of quartz veins and S-shaped tension gashes



Dextral movement: Z-shaped tension gashes, F₃ Z-folds, S₃ cleavage, boudins, shear bands

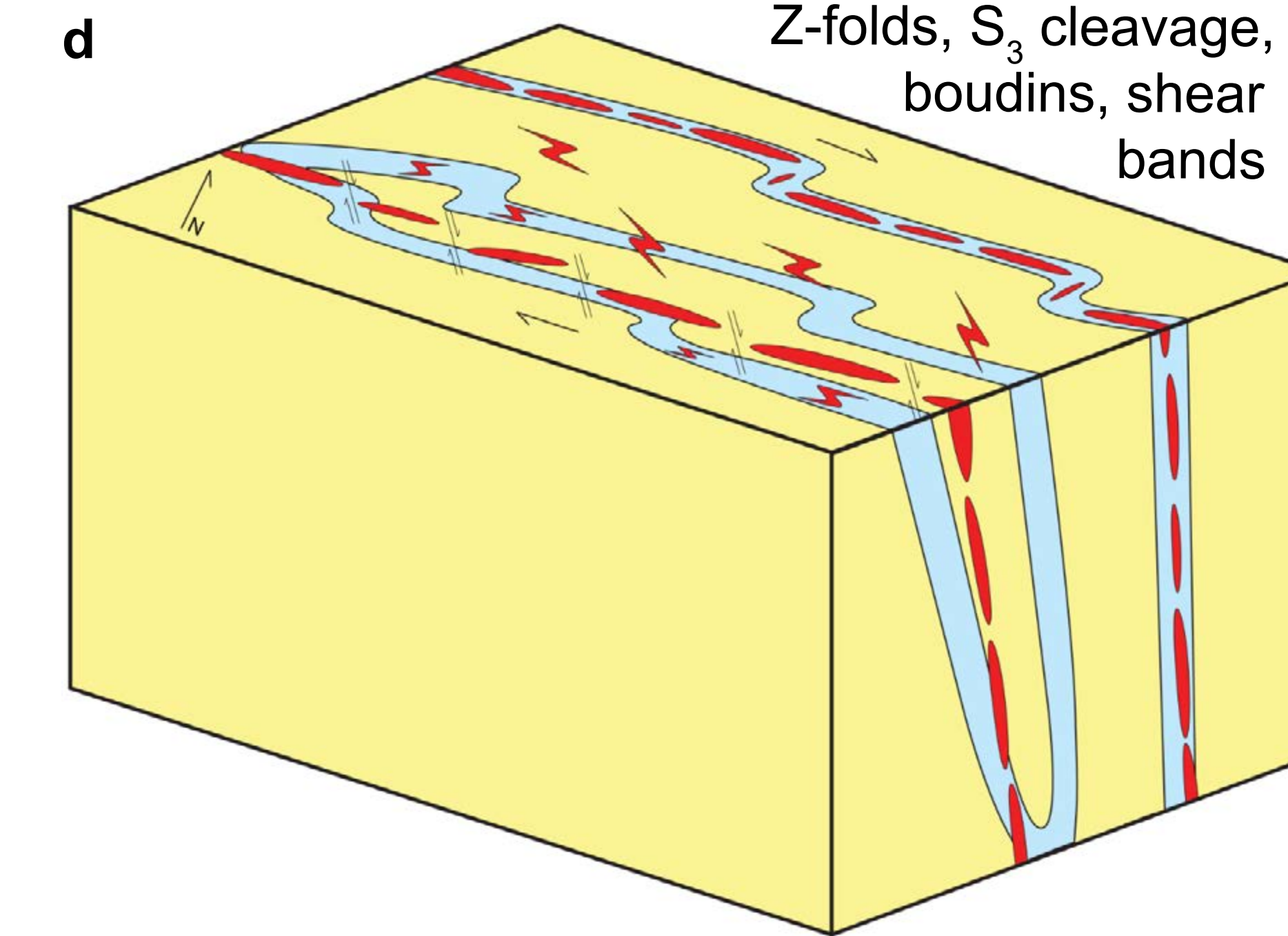


Figure 2: Schematic diagrams depicting the effects of the regional deformation history from a - d. a) Original horizontal stratigraphy prior to deformation. Sediments were likely deposited in an extensional basin. b) NE-SW shortening caused regional isoclinal F₁ folds and an axial planar S₁ cleavage. c) Sinistral bedding-parallel shearing and compression emplaced continuous extensional quartz veins and sigmoidal S-shaped tension gashes. d) Late dextral shearing emplaced Z-shaped tension gashes and overprinted previous structures with F₃ Z-folds, an axial planar S₃ cleavage, boudinage and shear bands. Yellow lithology = turbidite; blue lithology = conglomerate; red features = quartz veins.

Regional folding: F₁ folds with an axial planar S₁ cleavage

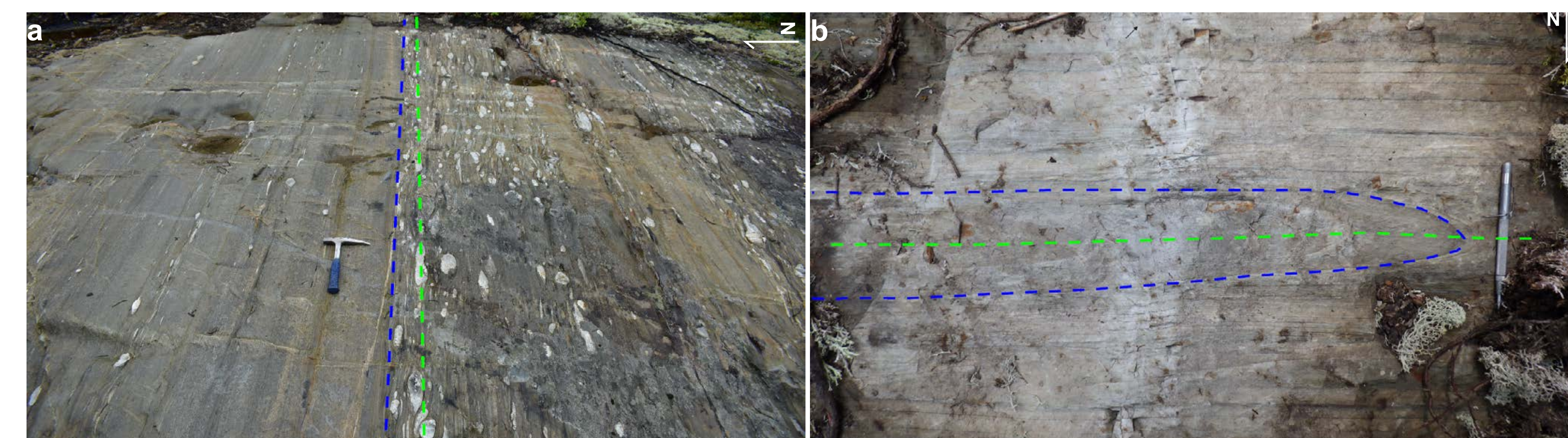


Figure 3: a) Polymictic conglomerate and bedded sandstone of the Timiskaming Group with bedding parallel S₁ cleavage defined by the conglomerate clasts. b) Isoclinal F₁ fold with an axial planar S₁ cleavage.

Dextral movement: Overprinting with F₃ folds, S₃ cleavage, boudins, shear bands and Z-shaped tension gashes

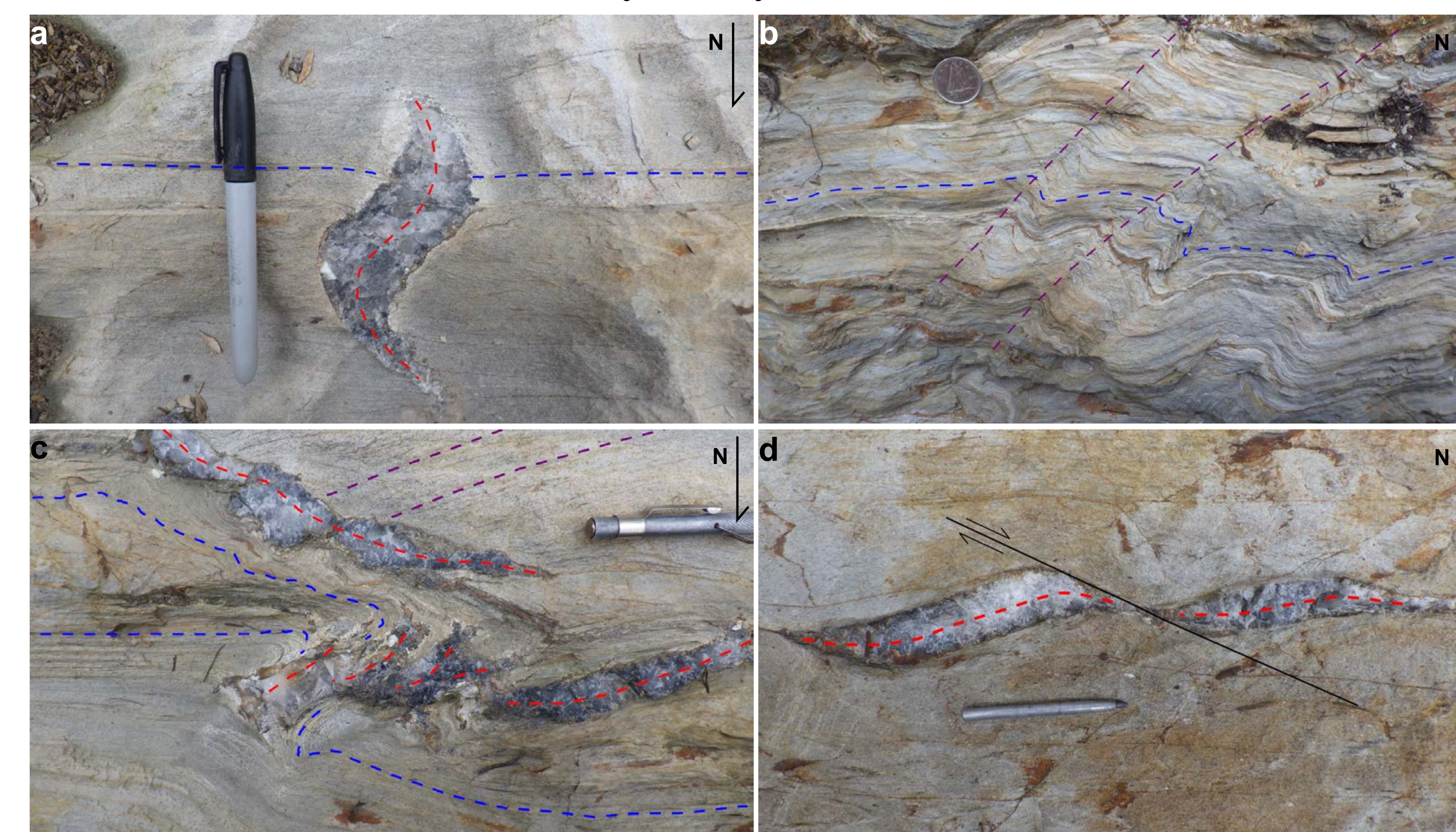


Figure 5: a) Sigmoidal Z-shaped tension gash. b) F₃ Z-folds with an axial planar S₃ cleavage. c) Z-folded flanking structures on quartz veins with an axial planar S₃ cleavage. d) Boudinaged quartz veins along a dextral shear band.

Sinistral movement: Emplacement of extensional quartz veins and S-shaped tension gashes

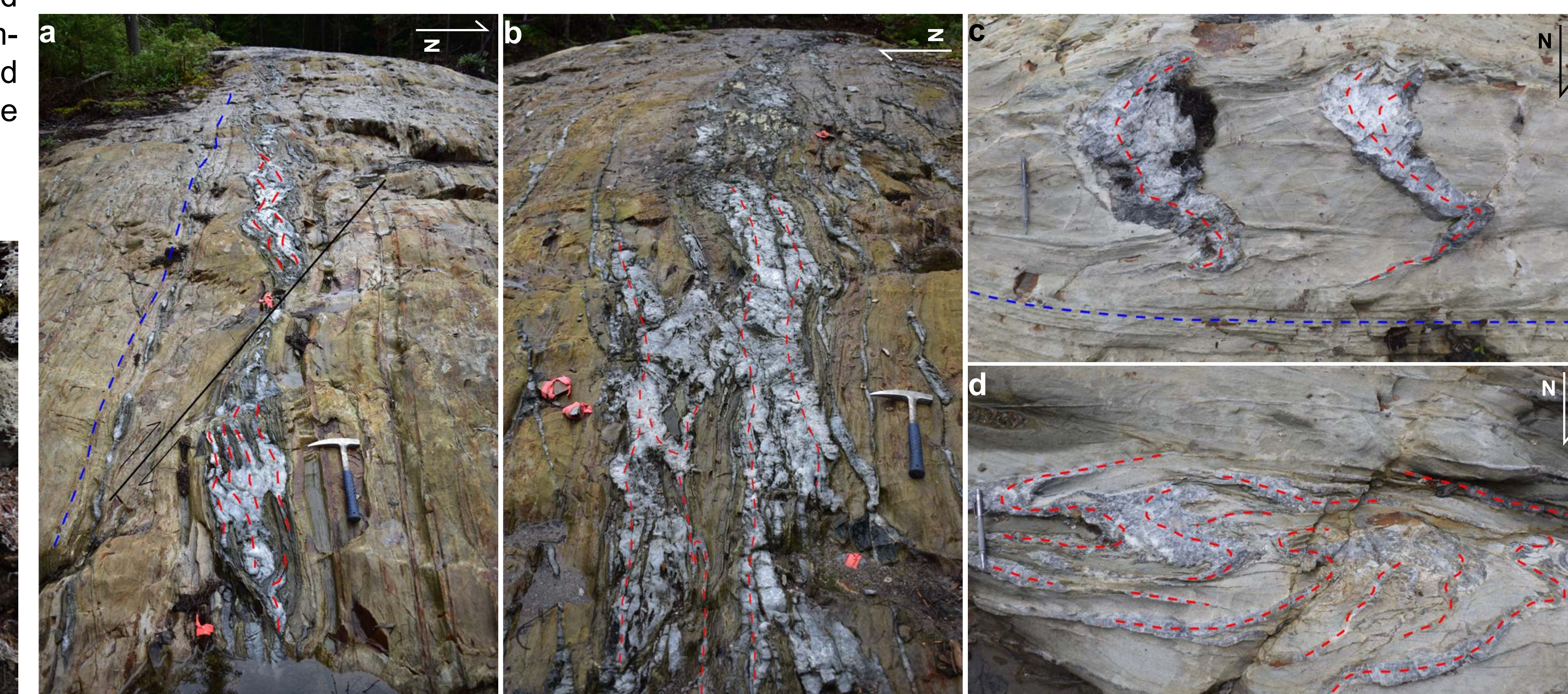


Figure 4: a) S-folded and boudinaged extensional quartz veins. b) Deformed extensional quartz veins. c) S-folded quartz tension gashes. d) S-folded en échelon quartz veins.

CONCLUSION

Three deformation events affected the supracrustal rocks in the Malartic segment of the LLCDZ. The first deformation event caused regional folding, where isoclinal F₁ folds plunge moderately to the ESE with an axial planar S₁ cleavage. During the second deformation event, extensional quartz veins and S-shaped tension gashes were emplaced as a result of sinistral transpression. The NW-SE-trending quartz veins are oriented anticlockwise and subparallel to the NW-trending bedding. Finally, during the third deformation event, Z-shaped tension gashes were emplaced and previous structures were overprinted by F₃ Z-folds, an axial planar S₃ cleavage, boudinage and shear bands caused by late dextral shearing.

Gold mineralization is hosted within the quartz veins and their associated alteration halos. The alteration assemblage is characterized by chlorite-sericite-biotite-arsenopyrite. Previous assays returned values of 1.7-41 g/t Au (Midland Exploration, 2016). Mineralization at Canadian Malartic (~10 km SE of the study area) is associated with veins that were emplaced along major E-W and NW-SE-trending D₂ faults and shear zones subparallel to the S₂ cleavage (e.g., De Souza et al., 2015; Perrouy et al., 2017). Hence, it is interpreted that the mineralizing fluid within the study area could represent a similar fluid to that of Canadian Malartic.

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