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

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The Larder Lake–Cadillac deformation zone (LLCDZ) in the Abitibi greenstone belt of the Archean Superior Province is a major crustal-scale deformation zone hosting numerous world-class gold deposits. This large-scale structure follows the boundary between the Abitibi and Pontiac subprovinces and is interpreted to have formed during the accretion of the Pontiac to the Abitibi subprovinces. The study area is situated along the NW-trending Malartic segment of the E-trending LLCDZ. Supracrustal rocks include ultramafic and mafic flows of the Piché Group, turbidites with local iron formation and conglomerates of the Cadillac Group (< ca. 2686 Ma), and polymictic conglomerates, sandstones and argillites of the Timiskaming Group (< ca. 2676 Ma). The metamorphic grade of the area is greenschist to amphibolite facies. At least three deformation events (D_1, D_2, D_3) occurred after the deposition of these supracrustal rocks. The D_1 event is characterized by a strong regional S_1 cleavage, striking west-northwest and dipping steeply to the north. S_1 is axial planar to west-northwest-striking, tight to isoclinal F_1 folds plunging moderately to shallowly to the east-southeast. The D_2 event is represented by a sinistral bedding-parallel shear indicators, expressed by sigmoidal S-shaped tension gashes and en échelon quartz veins oriented anticlockwise to bedding and to the regional S_1 cleavage. The D3 event is characterized by the deformation and boudinage of the en échelon veins, the formation of dextral shear bands, and folding of the veins and bedding by Z-shaped F_3 drag folds with an axial planar S_3 cleavage. Gold mineralization is hosted within the en échelon quartz veins and their associated alteration halos and was therefore emplaced during the D_2 event. The wall rocks to the veins are altered over 10-20 cm by chlorite, sericite, biotite and arsenopyrite. Previous assays returned values of 1.7 – 41 g/t Au. The study area is located 10 km northwest of the Canadian Malartic mine, a low-grade, large-tonnage deposit with gold endowment greater than 18 Moz. Mineralization at the Canadian Malartic mine is located along major D_2 structures and is interpreted to have been emplaced during D_2 deformation. Hence, it is thought that the mineralization within the study area could be associated with a similar influx of auriferous fluids as the Canadian Malartic deposit.