INTRODUCTION

The Canadian Malartic deposit is located in the Abitibi region of northwestern Quebec, immediately south of the town of Malartic, about 25 km west of Val d’Or and 550 km northwest of Montreal (Figure 1). Gold was first discovered in the area in 1923 and mining was conducted between 1928 and 1965. In this period, 9,931,376 tonnes of ore at an average grade of 3.37 g/t Au were extracted, for an aggregate production of 33,468 kg (1.076 Moz) Au.

The Malartic deposit straddles the southern margin of the eastern portion of the Abitibi Subprovince (2705 – 2698 Ma). The latter is limited to the north by gneisses and plutons of the Opatica Subprovince, and to the south by metasediments and intrusive rocks of the Pontiac Subprovince (Figure 1). The contact between the Pontiac and the Abitibi subprovinces is characterized by a major fault corridor, the east-west trending Cadillac-Larder Lake Tectonic Zone. The main lithostratigraphic divisions in this region are, from south to north, the Pontiac Group of the Pontiac Subprovince, and the Piché, Cadillac, Blake River, Kewagama and Malartic groups of the Abitibi Subprovince. These units are folded into a regional synclinal structure variously known as the Malartic or Cadillac Syncline, and have been metamorphosed to greenschist facies.

Most of the Canadian Malartic area lies immediately to the south of the Cadillac Tectonic Zone, and is underlain by the metasedimentary units of the Pontiac Group, which comprise dark grey to black turbiditic greywackes, siltstones and mudstones. The north-central portion of the property covers a ~3.5 km-long section of the fault corridor and is underlain by mafic to ultramafic metavolcanic rocks of the Piché Group and metasediments of the Cadillac Group. Two major structures, the Malartic (Cadillac) and Sladen Faults, define the northern and southern boundaries of the tectonic zone in the area. Piché Group rocks in the fault zone are typically bluish-grey, strongly foliated and contain numerous talc-carbonate veinlets. Less altered variants occur as massive, aphanitic to fine grained serpentinized ultramafic rock. Both groups are intruded by a number of epizonal felsic porphyritic bodies, variously described as syenites, quartz syenites, quartz monzonites, granodiorites and tonalites. The geometries of these intrusions are highly variable, and may take the form of sills, dykes, discontinuous lenses or small isolated stocks. The porphyries are all feldspar-phyric with fine-grained to aphanitic, medium to light grey groundmass. The Fournière granodiorite/tonalite pluton adjoins the southeastern extremity of the property.

Recent work by Osisko Mining Corp. at Canadian Malartic has recognized potentially economic gold
mineralization in the form of a nearly continuous shell of 1-5% disseminated pyrite associated with fine-grained native gold, chalcopyrite, sphalerite and tellurides, that surrounds the old mine workings (Fallara et al, 2000). This large tonnage, low grade mineralization is hosted mostly by altered clastic sediments of the Pontiac Group and the upper parts of a porphyry intrusion. Mineralized metasedimentary and porphyritic rocks are characterized by widespread potassic (K-feldspar, biotite), and sericite-carbonate alteration, locally overprinted by silicification, and late stage chloritization.

Mineralization at Canadian Malartic has several characteristics that differ from typical Archean greenstone-hosted or 'orogenic' deposits elsewhere in the Abitibi. For example, gold is associated with finely disseminated pyrite and narrow quartz-biotite-carbonate veinlets with potassic alteration haloes rather than the discrete quartz-carbonate veins and albite-carbonate alteration that characterize many other deposits. Similarly, in contrast to most Abitibi-type deposits, mineralization at Canadian Malartic is hosted by metasedimentary rocks of the Pontiac Group, occurs south of the main Cadillac fault zone, and may be genetically associated with magmatic fluids derived from a porphyritic intrusion. These features make the Canadian Malartic deposit an interesting study area in which to evaluate the genesis of a poorly understood but potentially important type of Archean gold mineralization.

**Figure 1.** Location and general geology of the southern Abitibi region (Osisko Mining Corp.)
OBJECTIVES AND METHODOLOGY
The main objective of this project is to try to reconstruct the genesis of the Canadian Malartic deposit by evaluating: a) the geochemistry and distribution of alteration and gold mineralization; and b) the nature and origin of the fluids responsible for the mineralization, and their relationship to magmatism.

Alteration and mineralization studies
The study of alteration and mineralization will be divided in two main components: the first involves the identification of the ore and alteration mineral assemblages using a combination of optical/SEM microscopy and electron microprobe analysis; and the second component involves the geochemical analysis of bulk compositions of altered and fresh rocks and their evaluation using the methodology of Grant (1986). The latter is based on establishing which elements can be considered as immobile during alteration, and using these constraints to quantify the mass changes in the system caused by hydrothermal processes associated with mineralization.

Fluid inclusion studies
The fluid compositions and physicochemical conditions responsible for gold mineralization will be studied using quartz- and K-feldspar-hosted fluid inclusions. If pyrite proves to be transparent to infrared radiation, the study will be extended to inclusions hosted by this phase, which as noted earlier is intimately associated with gold mineralization. Microthermometry will be used to estimate P-T trapping conditions, and compositional data such as salinity. A combination of SEM-EDS analyses of the residues of decrepitated fluid inclusions and bulk-crush leachate analyses will be used to get additional compositional information. Selected samples will be evaluated for LA-ICPMS analysis. The composition of the gas phase will be analyzed for H₂, CO₂, H₂S and CH₄ using a combination of Raman spectroscopy and gas chromatography.

REFERENCES

