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GEOLOGICAL SURVEY, WE-GD PROJECT

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WE-GD PROJECT:

GEOLOGICAL SURVEY

NTS 32 G/11

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TABLE OF CONTENTS

SUMMARY

The WE-GD property is located in the east-central part of Guercheville Township, approximately 80 km southwest of Chibougamau, Québec.

The WE-GD claims were optioned from Win-Eldrich Mines Ltd. in March, 1987 by Esso Minerals Canada. The property comprises 30 claims covering 480 ha.

A program of geological mapping and prospecting was carried out between June 29 and July 29, 1987.

The WE-GD project lies between the Chibex and Lac Shortt deposits in the north-eastern part of the Abitibi Greenstone Belt. The southwestern part of the property is underlain chiefly by mafic metavolcanic rocks intercalated with clastic metasedimentary units and local graphitic horizons. Minor late feldspar porphyry dikes and diabase cut the sequence.

INTRODUCTION

Location and Access

The WE-GD project is located in the north-eastern part of the Abitibi Greenstone Belt, 80 km southwest of Chibougamau, Québec and is centered at latitude 49° 31'30" N and longitude 75° 18'30" W (Figure 1).

The WE-GD property is located in the east-central part of Guercheville Township. The property comprises 30 claims covering an area of 480 ha (Appendix I).

Access to the property is by all-weather forestry roads: southerly from Route 113 at km 317 for 38 km and easterly on a subsidiary logging road that borders the property.

History

Semi-detailed mapping in the WE-GD area was carried out by Deland (1955) and Remick (1956, 1957). The area was covered in a regional reconnaissance geological survey carried out by Gobeil and Racicot (1982). Semi-detailed mapping was carried out by L. Tait and E.H. Chown in 1986 in the du Guesclin area for the M.E.R. (DP-87-12).

Gold exploration in the area has been sporadic since the late 1940's with most of the work concentrated in the Lac Mina and the Lac Fenton areas. In the late 1940's Cominco intersected significant gold concentrations near Lac Fenton; values in diamond drill core ranged up to 10.82 gm/t Au over 10.96 m. The Lac Fenton area was further investigated in the early 1980's by SDBJ and recently, by Bay Resources.

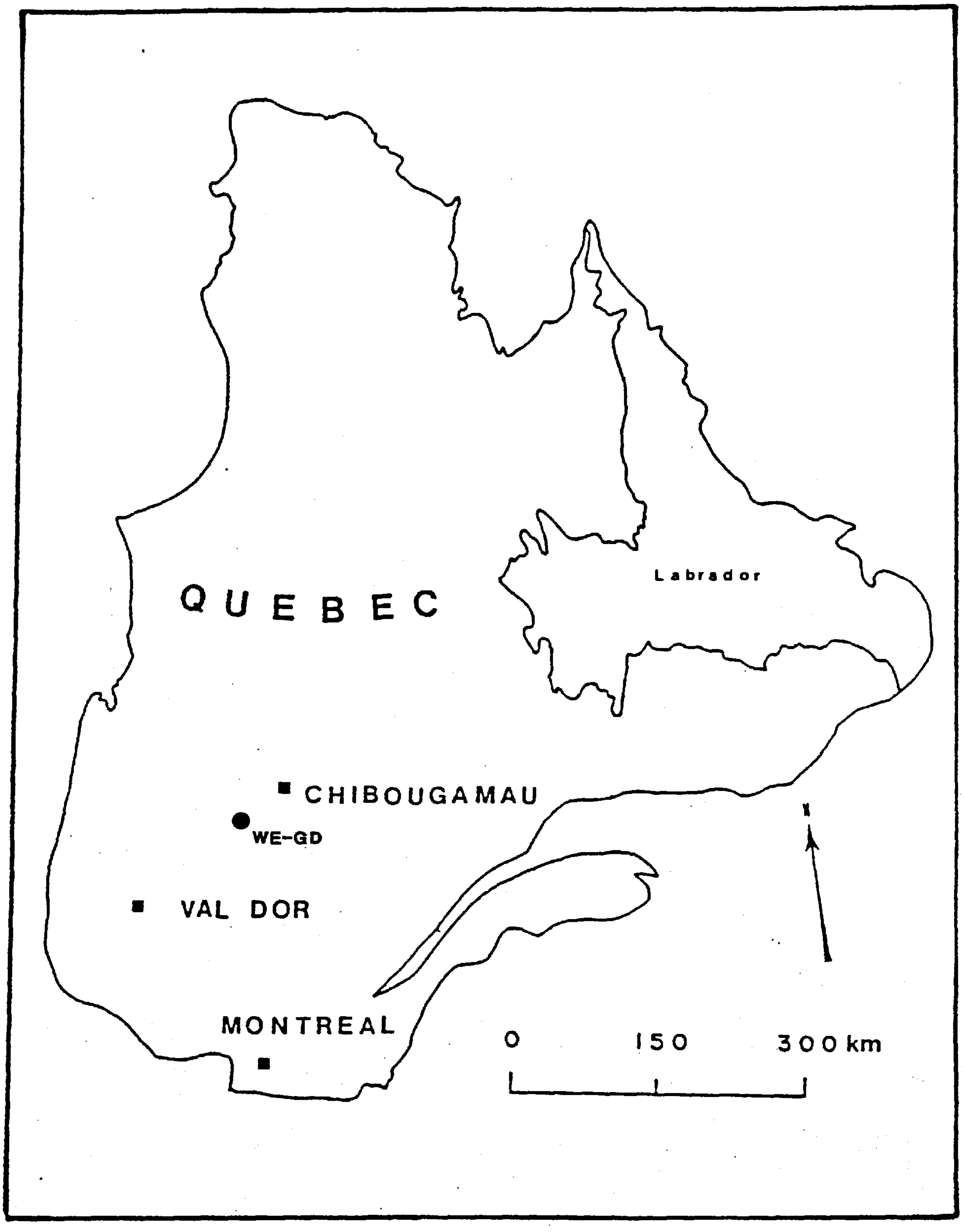

Figure 1: Location of the WE-GD project in the province of Québec.

In the late 195Ø's Steerola Explorations diamond drill tested a gold occurence north of Lac Mina and about Ø.5km south of the WE-GD property. Partial results of this work indicate anomalous but subeconomic gold concentrations (GM 8Ø44).

In addition to SDJB and Bay Resources, other companies recently active in the area include Exploration Orbite, Ressources Minière Aabarock, Argentex, Victoria Diego/Fairlady Resources and Esso Minerals.

The WE-GD property was optioned from Win-Eldrich Mines by Esso Minerals Canada in March 1987.

REGIONAL GEOLOGY

The WE-GD prospect is located in the eastern part of the Abitibi greenstone belt. The main features of the Abitibi greenstone belt are summarized in Figure 2.

The Abitibi belt is approximately 7ØØ km in length, and 2ØØ km in width. It is the largest greenstone belt in the Superior Province. On the east it is bounded by the younger (95Ø MY) Grenville Province (Figure 2). The boundary between the two provinces is major tectonic zone called Grenville Front. It separates the low-grade metavolcanic rocks of the Superior Province from the high-grade gneisses of the Grenville Province (Allard, 1972). Allard (1976, 1978, 1981) has demonstrated that the rocks of the Abitibi belt in the Chibougamau District extend to Grenville Province. On the west, the Abitibi belt is bounded by the Kapuskasing structural zone (Figure 2). This zone is an elongate NE trending structurally discordant region of high-grade gneisses which is Proterozoic in age. To the north and south, the belt is bounded by high-grade gneisses which may represent older basement terrane (Dallmeyer, 1974; Racicot et al., 1984).

The Abitibi belt consists of a thick sequence of volcanic and sedimentary rocks which have been isoclinally folded into large scale anticlinoria and synclinoria, metamorhposed, and intruded by several large granitic batholiths.

Regional stratigraphic successions within the belt can be considered in terms of a large basin, with marginal (proximal) and interior (distal) facies (Goodwin, 1977). The marginal parts of the belt are characterized by large volcanic centres. The centres are composed of several shield-type volcanoes (Goodwin, 1977) comprised of lower dominantly tholeiitic parts, and upper calc-alkalic parts (Goodwin, 1972, 1977). The change in lithology from mafic to felsic is not abrupt, but takes place

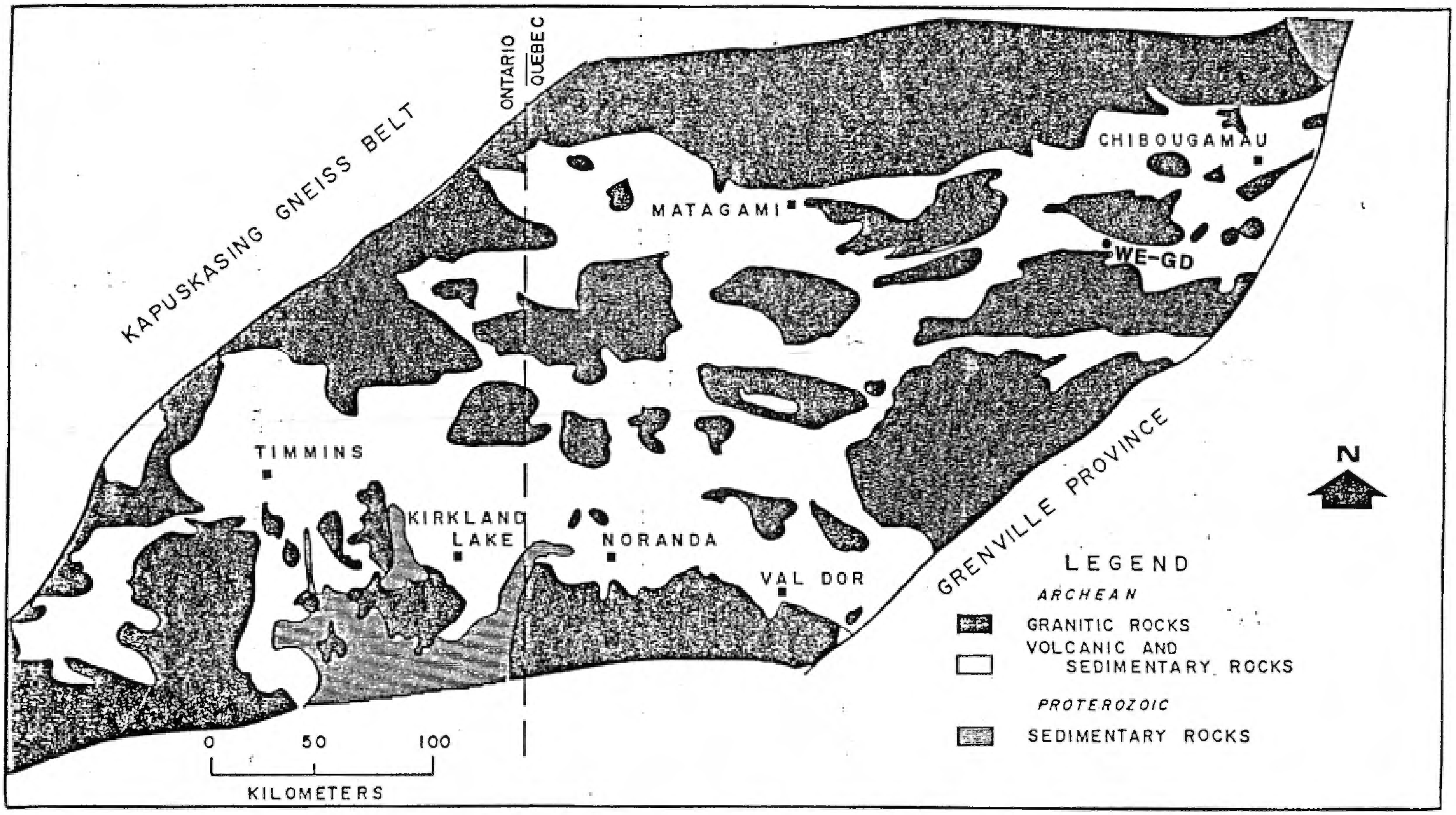

Figure 2 - General geology of the Abitibi greenstone belt.
(After Goodwin and Ridler, 1970; and Allard, 1976)

over a stratigraphic range of varying thickness by interlayering of flows of different compositions. Generally more than one mafic to felsic cycle makes up a succession (Ridler, 1970; Baragar, 1971; Allard et al., 1972; Goodwin, 1972,1977), and the entire succession is generally conformable.

Mafic portions of the volcanic sequences are dominated by massive and pillowed flows which show evidence of having been deposited in a submarine environment. Mafic sills with compositions similar to their host rocks are generally abundant in the mafic part of the sequences (Baragar, 1971). In several volcanic centres large layered ultramafic to mafic complexes are present in the tholeiitic parts of the sequences. The calc-alkalic parts of the successions are composed mainly of intermediate to felsic flows, and small felsic intrusions (Baragar, 1971; Goodwin, 1972, 1977).

Clastic and chemical sedimentary rocks are present in the stratigraphic successions in all of the volcanic centres. They characteristically occur in the upper part of the mafic to felsic cycles. The clastic sedimentary rocks consist of poorly sorted conglomerates, breccias, and coarse-grained turbidites, derived mainly from the volcanic rocks lower in the succession. They are spatially very closely associated with the calc-alkalic volcanic edifices, and grade into the volcanic rocks (Goodwin, 1972, 1977). The sedimentary sequences generally fine upwards and pass gradually into chert-rich oxide facies iron formation. Oxide facies iron formations occur as thick and extensive units which cap the different mafic to felsic cycles in the volcanic centres (Ridler, 1976; Goodwin, 1972, 1977).

As in the marginal parts of the belt, the stratigraphic successions in the interior are characterized by several mafic to felsic cycles with associated clastic and sedimentary rocks.

However, in the interior parts of the belt, these cycles are composed mainly of tholeiitic mafic flows with coeval mafic intrusions and only insignificant amounts of calc-alkalic intermediate to felsic volcanics (Goodwin & Ridler, 1970; Descarreaux, 1973; Goodwin, 1977). The clastic sedimentary rocks which are found in upper part of the cycles consist of distal fine to medium grained turbidites. The mafic to felsic cycles are capped by thin discontinuous units of carbonate and sulphide facies iron formation. The changes in the nature of clastic and chemical sedimentary rocks is interpreted by Ridler (1976) and Goodwin (1977) as being indicative of a change in the paleoslope of the basin and depositional environment.

The volcanic rocks of the Abitibi belt have been intruded by several granitic batholiths and stocks. Most of these plutons are located in the interior of the belt, but several of the volcanic centres have also been intruded by granitic plutons. The granitic plutons can be subdivided into two groups: syn-kinematic tonalitic to dioritic plutons, and post-kinematic granite to granodiorite plutons. The rocks in the post-kinematic plutons are generally massive and usually more potassic than the rocks they intrude (Viljoen & Viljoen, 1969; Anhauser, 1973; Hickman & Lipple, 1975; and Glikson & Lambert 1976). These plutons are concordant on a regional scale and discordant on a local scale. Structural evidence from within the plutons and surrounding volcanics is indicative of a diapiric mode of emplacement (Drury, 1977; Goodwin & West, 1974).

Radiometric age dating of undeformed post-kinematic plutons within the Abitibi belt by Wanless and Loveridge (1972),Steiger and Wasserburg (1969), and Dallmeyer et al., (1975) suggests that many batholiths were emplaced during the period 2650-2700 M.A. Age dates from deformed pre-or syn-kinematic tonalitic-dioritic plutons by Krough and Davis (1971), Wanless et al., (1970) indicate a time of intrusion between 2780 M.A. and 2820 M.A. (Dallmeyer et al., 1975).

Metamorphism in the Abitibi belt is commonly of greenschist grade, and even as low as zeolite grade in a few localities (Jolly, 1974; Goodwin 1977; Dimroth et., 1982, 1983). However, close to the boundaries of the belt and adjacent to the granite-granodiorite stocks and batholiths the grade of metamorphism reaches amphibolite and hornblende hornfels, respectively (Dimroth et al., 1982, 1983). Age dates from pre-kinematic and post-kinematic granitic plutons suggest that Kenoran metamorphism must have occurred between 2650-2700 M.A. and 2780-2820 (Dallmeyer et al., 1975).

The main structural feature of the Abitibi belt is a series of large east-west trending isoclinal folds (Goodwin, 1977). In Timmins and Chibougamau mining camps, north-south trending folds are also present (Allard et al., 1972; Davies, 1977; Karvinen, 1981; Daigneault & Allard, 1984). In the Chibougamau area north-south trending folds are older than east-west trending folds (Daigneault & Allard, 1983, 1984). Age relationships between the two generations of folds in the Timmins area are unclear at present. In addition, there has been some localized folding adjacent to some of the large granite-granodiorite batholiths. Another important feature of the Abitibi belt is the presence of large faults and/or shear zones in the marginal parts of the belt. The Porcupine-Destor fault in the Timmins camp, and the Cadillac-Larder Lake fault in the Val-d'Or, Noranda, and Kirkland Lake camps have strike lengths in excess of 100km. They developed as zones of normal faulting during accumulation of the supracrustal sequence. During the Kenoran orogeny they were transformed into zones of thrust faulting (Dimroth et al., 1982, 1983).

Information on the displacements along these major structures is lacking but it is believed to be on the order of several kilometers. Several generations of smaller faults and shear zones are common in all parts of the belt.

The evolution of the Abitibi belt during Archean time can be briefly summarized as follows: (1) volcanism and sedimentation on a pre-existing gneissic basement prior to 2780-2820 M.A., and intrusion of tonalitic-dioritic plutons into the volcanic and sedimentary rocks in the period 2780-2830 M.A.;(2) metamorphism and deformation during the Kenoran orogeny in the period 2650-2700 M.A. to 2780-2820 M.A.; (3) intrusion of post-kinematic potassic plutons at 2650-2700 M.A. The rocks along the western margin of the Abitibi belt were deformed during the formation of the Kapuskasing structural zone in the Hudsonian orogenic event (1800 M.A.). The rocks along the eastern boundary of the belt were deformed during the Grenville orogeny (950 M.A.).

GEOLOGY OF THE CHIBOUGAMAU DISTRICT

The Chibougamau district is situated in the extreme north-eastern part of the Abitibi greenstone belt (Figure 2). Supracrustal rocks in the area have been divided into two groups: the Roy Group, and the Opemiska Group. The distribution of the different stratigraphic units in the district is shown in Figure 3.

SUPRACRUSTAL ROCKS

Roy Group

The Roy Group is comprised of two mafic to felsic volcanic cycles. The lowermost unit of the first volcanic cycle is the Obatogamau Formation. This formation is extensive and has been traced westward from the Grenville front for over 100 km. It consists of 3,000 metres of pillowed basalts and numerous gabbro sills. The basalts are plagioclase phyric at many localities. Felsic to intermediate tuffs and breccias constitute a very small portion of the formation. The extent of the formation and the nature of the flows are indicative of a submarine lava plain environment (Allard et al., 1984).

Rocks of the Obatogamau Formation are overlain by those of the Waconichi Formation. It is less than 1,000 metres thick and is comprised of porphyritic soda-rhyolites, felsic tuff breccias, a few lenses of basaltic flows and tuffs, hyaloclastites and iron formation. The distribution of the various lithologies is indicative of widespread felsic volcanism localized in many small submarine eruptive centers. The small volcanic edifices are locally capped by a carbonate and/or sulphide facies iron formation (Lac Sauvage Iron Formation).

Rocks of the first volcanic cycle are conformably overlain by the pillowed basalts and comagmatic gabbro sills of the Gilman Formation. It has a maximum thickness of 3,600 metres in the central part of the Chibougamau district and thins in all directions away from the center. The nature and distribution of the different flow units are similar to those of large central shield volcanic complexes (Allard et al., 1984).

The Blondeau Formation is the upper part of the second volcanic cycle. Rocks of this formation conformably overlie those of the Gilman Formation. It is approximately 1,000 metres thick and consists of variolitic basalts, rhyolitic flows, felsic tuffs and breccias, cherty and graphitic tuffs and argillites, and volcanogenic sandstones and greywacke. Relationships among the different facies are interpreted by Dimroth et al., (1982) and Archer (1984) as the result of volcanism creating emerging volcanic islands and concurrent erosion and sedimentation in adjacent sedimentary basins.

The Bordeleau Formation as defined by Caty (1979) is restricted to the Waconichi Syncline north of Chibougamau. It is comprised of volcanogenic sandstones. Mueller et al., (1984) interpret this formation to be part of the Chebistuan/Stella Formation. The inferred environment of deposition is fault bounded basins adjacent to emerging volcanic islands.

Opemiska Group

The contact between rocks of the Roy Group and those of the Opemiska Group ranges from a conformable transitional contact to a profound unconformity (Allard et al., 1984). Cimon (1976) subdivided rocks of the Opemiska Group into the Stella and Hauy Formations. At the type localities in the Chapais syncline the Stella Formation is comprised of a basal polymictic conglomerate succeeded upward by an interlayered sequence of feldspathic sandstones and argillites. The overlying Hauy Formation consists of an intercalated sequence of feldspathic sandstones, argillites, and porphyritic potassic andesites.

On the basis of sedimentological and volcanological studies, Dimroth et al., (1982) suggest that rocks of these formations should be considered as a single unit. Paleogeographic reconstruction of the sedimentary basins represented by rocks of this group indicate contemporaneous subaerial volcanism, rapid erosion, and sedimentation in adjacent fault bounded basins.

MAFIC INTRUSIONS

Supracrustal rocks in the Chibougamau district have been intruded by several concordant mafic layered complexes. The Dore Lake Complex has been emplaced into the upper part of the Waconichi Formation. The Chaleur Lake Complex is intrusive into rocks of the Gilman and Blondeau Formation whereas the Opawica River Complex has been intruded into rocks of the Obatogamau Formation. These intrusions are characterized by a suite of rock types and primary structures are similar to those found in other well studied layered intrusions such as the Bushveld and Skaergaard Complexes (Allard et al., 1984).

The Cummings Complex has been emplaced into rocks of the Blondeau Formation. It is comprised of three sills which have been traced westward from the Grenville front for over 160 km. The three sills always occupy the same relative stratigrahic positions. The lower-most Roberge sill consists of dunite and peridotite. The Ventures sill which occupies a slightly higher stratigraphic position is composed of gabbro. The stratigraphically highest Bourbeau sill is comprised of leucogabbro and quartz ferrodiorite. Each of the three sills is differentiated and the three sills together form a larger differentiated unit (Allard et al., 1984).

GRANITIC ROCKS

The greenstone belt in the Chibougamau district is bordered to the north and south by granitic plutons and gneisses. Within the greenstone belt Racicot et al., (1984) have subdivided felsic intrusions into four categories: remobilized basement domes, pre-kinematic intrusions, syn-kinematic intrusions, and post-kinematic intrusions.

Basement domes such as the Lapparent Massif are composed of migmatized tonalite-diorite gneiss that has been intruded by two generations of mafic dykes and subjected to at least three major deformation events. Pre-kinematic plutons ie the Chibougamau Pluton are composite intrusions of tonalitic to dioritic composition. Syn-kinematic plutons occur in two distinct tectonic settings and show two distinct petrographic suites.

They occur either along the contact between basement and younger supracrustal rocks or in discreet masses with sub-circular outlines along major tectonic highs. Compositionally they belong either to a quartz monzonite or tonalite suite. There are pronounced contact metamorphic aureoles (associated with these intrusions) which are in part superimposed on fabrics developed in regional structural events. Post-kinematic plutons are granodioritic in composition. They are often prophyritic and exhibit compositional zoning rather than multiple intrusion. Adjacent wall rocks are locally deformed and extensive contact metamorphic aureoles superimposed on earlier fabrics are present around the plutons.

STRUCTURAL DEVELOPMENT

The Abitibi greenstone belt in the Chibougamau district has the form of a major synclinorium developed on basement granitic gneisses. Polyphase deformation has affected all the lithologies within the greenstone belt. The Chibougamau anticline is the central structure of the area, and is bordered to the south by the Chapais syncline and to the north by the Chibougamau syncline (Duquette, 1970). West of Chapais, the two synclines merge into a major synclinorium. Caty (1977) has identified the Waconichi anticline and syncline north of the Chibougamau syncline. South of the Chapais syncline Hebert (1980) has mapped the La Dauversiere anticline.

Early north trending folds have been reported by Allard (1976), Durocher (1978), Hebert (1979) and Daigneault et al., (1983, 1984). Sedimentary rocks of the Opemiska group have not been affected by the early north-south folding event. All supracrustal rocks have been affected by the regional east-west folding event.

On the basis of radiometric age dates, the regional east-west folding event and contemporaneous metamorphism occurred between 2,650 and 2,820 M.A. (Dallmeyer et al., 1975).

Rocks in the Chibougamau district are transected by four major systems of faults. East-west striking faults are generally subparallel to lithological contacts, are up to 1 km wide and can be traced for several tens of kilometers along strike. Rocks within and adjacent to these faults are highly carbonatized. Charbonneau (1981), Allard (1982) and Daigneault et al., (1983) mapped the Kapunapotagen fault in the Chapais syncline. It has been traced westward from the Grenville front for over 80 km. The nature of the fault and its sense of movement have not been established. The fault separates south facing sedimentary rocks of the Opemiska Group and north facing volcanic rocks of the Roy Group (Allard et al., 1984). The similar Faribault fault in the Chibougamau syncline separates north facing volcanic rocks of the Waconichi Formation and southward facing sedimentary rocks of the Bordeleau Formation (Daigneault et al., 1983).

The Mistassini Lake, the Tache Lake, the Dore Lake-McKenzie Narrows, and the Gwillim Lake faults are major northeast striking faults, which have an apparent left lateral sense of movement. The fault zones are several hundred metres wide and are comprised of an anastomosing network of faults and/or shear zones. On the basis of cross-cutting relationships, they are younger than E-W trending faults.

Where the Dore Lake-McKenzie Narrows fault transects the Dore Lake Complex, north-west striking faults and/or shears are common and in some cases host copper mineralization (Gobeil et al., 1984).

The area adjacent to the Grenville front is characterized by a series of closely spaced N-S to N2ØE striking faults. The spacing between faults increases westward away from the Grenville front. The faults are of a reverse nature and dips range from 5Ø° SE at the front to vertical a few kilometers west of the Grenville front. The area adjacent to the front is also characterized by a higher metamorphic grade and Grenville style and age fabrics and structures superimposed on older fabrics and structures (Allard et al., 1984).

ORE DEPOSITS IN THE CHIBOUGAMAU DISTRICT

To date 25 ore deposits have been discovered in the Chibougamau district. Of these twenty-five deposits, 18 are copper-gold fissure deposits, two are volcanogenic massive sulfide deposits and five are quartz vein type gold deposits. Seventeen of the copper-gold fissure deposits are situated in shear zones in the Anorthosite Zone of the Dore Lake Complex, and one deposit is localized in a border phase of the Chibougamau Pluton. The two massive sulfide deposits are situated in the felsic volcanic rocks of the Waconichi Formation. Several copper-zinc prospects occur in felsic volcanic rocks of the Blondeau Formation.

The gold deposits in the district are localized in or adjacent to zones of intense hydrothermal alteration and deformation. They are structurally controlled, and occur in a variety of rock types and in different formations. In addition, important deposits of vanadiferrous and titaniferrous magnetite occur in the layered zone of the Dore Lake Complex (Allard, 1976).

PROPERTY GEOLOGY

The geology over half of the WE-GD property was done along flagged lines spaced 1ØØ meters apart. The remaining part is largely swamp-covered and was not traversed. Reconnaissance geological mapping was also performed along the claim lines and the road bordering the property (Map No. 1).

The outcrop density is less than 5% in the map area. Exposures were observed only in the south-western part of the property. Swamp covers much of the northern part of the claims and sand plains are found in the southeastern portion.

The WE-GD claims are underlain by a metavolcanic-metasedimentary sequence. The predominant rock type is massive-to-pillowed, locally feldspar-phyric, mafic flows. A metasedimentary component of the sequence includes intercalated feldspathic wacke, feldspathic arenite and mudstone with local graphitic horizons. Pyrite, pyrrhotite and minor chalcopyrite are found in the latter unit. Airborne geophysical data indicate that rock units strike east-southeasterly (M.E.R. DP-927). Feldspar porphyry dikes and a later narrow diabase dike are observed along the road bordering the property.

A regional cleavage, S_2, is weakly to strongly developed in the pre-diabse units. Pillow flattening, minor folds and small-scale "P" shears are also related to a regional, D_2, deformation. Later kink bands are common.

Lithology

The main lithologies observed at the WE-GD property are as follows:

Mafic Metavolcanic Rocks

The mafic metavolcanic rocks comprise massive and pillowed lavas. Flows are fine-grained to medium-grained, green on fresh surfaces and gray-green to dark green on weathered surfaces. Feldspar phenocrysts, up to 1 cm, are locally present. Feldspar phyric mafic flows are diagnostic of the Obatogamau Formation elsewhere in the Chibougamau district.

Primary structures are poorly preserved. Pillow flattening precludes determination of stratigraphic tops. The mafic rocks are moderately to well-foliated; local intense cleavage development is signified by chlorite schist.

Fine to medium grained magnetite is disseminated in one outcrop. Epidote is locally concentrated along pillow selvages.

Metasedimentary Rocks

Feldspathic wacke, feldspathic arenite, and mudstone are intercalated with the mafic metavolcanic rocks. Wacke and arenite are mainly composed of fine to medium grained feldspar grains embedded in a gray-green chlorite-sericite matrix. Accessory minerals include pyrite, pyrrhotite and minor chalcopyrite; thin graphitic horizons are present. Black, highly graphitic, pyritic mudstone corresponds to a strong input anomaly at one locale (DP-927).

Felsic Instrusive Rocks

Feldspar porphyry dikes are subconcordant within mafic metavolcanic rocks and exhibit a maximum width of 1.2 meter.

The dikes are commonly gray on fresh surfaces and weather white, and are composed mainly of round to subround feldspar.

White quartz veins are observed along the contact between the volcanic unit and the porphyry dikes.

Diabase

A fine-grained diabase dike outcrops along the road bordering the property and is partially exposed across a width of 1.9m. Magnetite comprises up to 5% of the rock. The dike strikes approximately northeast-southwest.

Structure

Evidence of at least two deformational events is observed in the rocks of the WE-GD property. Regional deformation imparted a penetrative east-southeasterly striking fabric. Structural evolution during this regional event included development of: S_2 cleavage, flattened pillows, minor dextral folds plunging 28° to 32° northwesterly; and "P" shears, filled by barren quartz veins, at 1Ø°-2Ø° counterclockwise to the strike of S_2. A late stage in this major deformation is represented by boudinaged quartz veins. Evidence of a later deformational event comprises small-scale kink bands with an average strike of Ø2Ø°.

CONCLUSIONS AND RECOMMENDATIONS

The WE-GD property is 80 km southwest of Chibougamau, Québec and comprises 30 claims covering an area of 480 ha.

Limited exposure in the southwestern part of the claims includes mafic metavolcanic rocks which are intercalated with lesser amounts of feldspathic wacke, feldspathic arenite and graphitic mudstone. Feldspar porphyry dikes are a minor component of the succession. Late diabase cuts the metavolcanic/metasedimentary sequence. The rocks exhibit structures, including a penetrative cleavage, charateristic of progressive regional deformation.

Evidence of favourable criteria for economic gold concentrations, including intense hydrothermal alteration, was not observed in outcrop. Consequently, no further exploration is recommended at the WE-GD property.

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APPENDIX I

CLAIM STATUS

LICENCE #	CLAIMS	EXPIRY DATE
44Ø193	1 and 5	March 19, 1989
44Ø194	1 - 5	March 2Ø, 1989
44Ø195	1 - 5	March 21, 1989
44Ø196	1 - 5	March 22, 1989
44Ø197	1 - 5	March 23, 1989
44Ø198	1 - 5	March 24, 1989
44Ø199	1 - 5	March 19, 1989

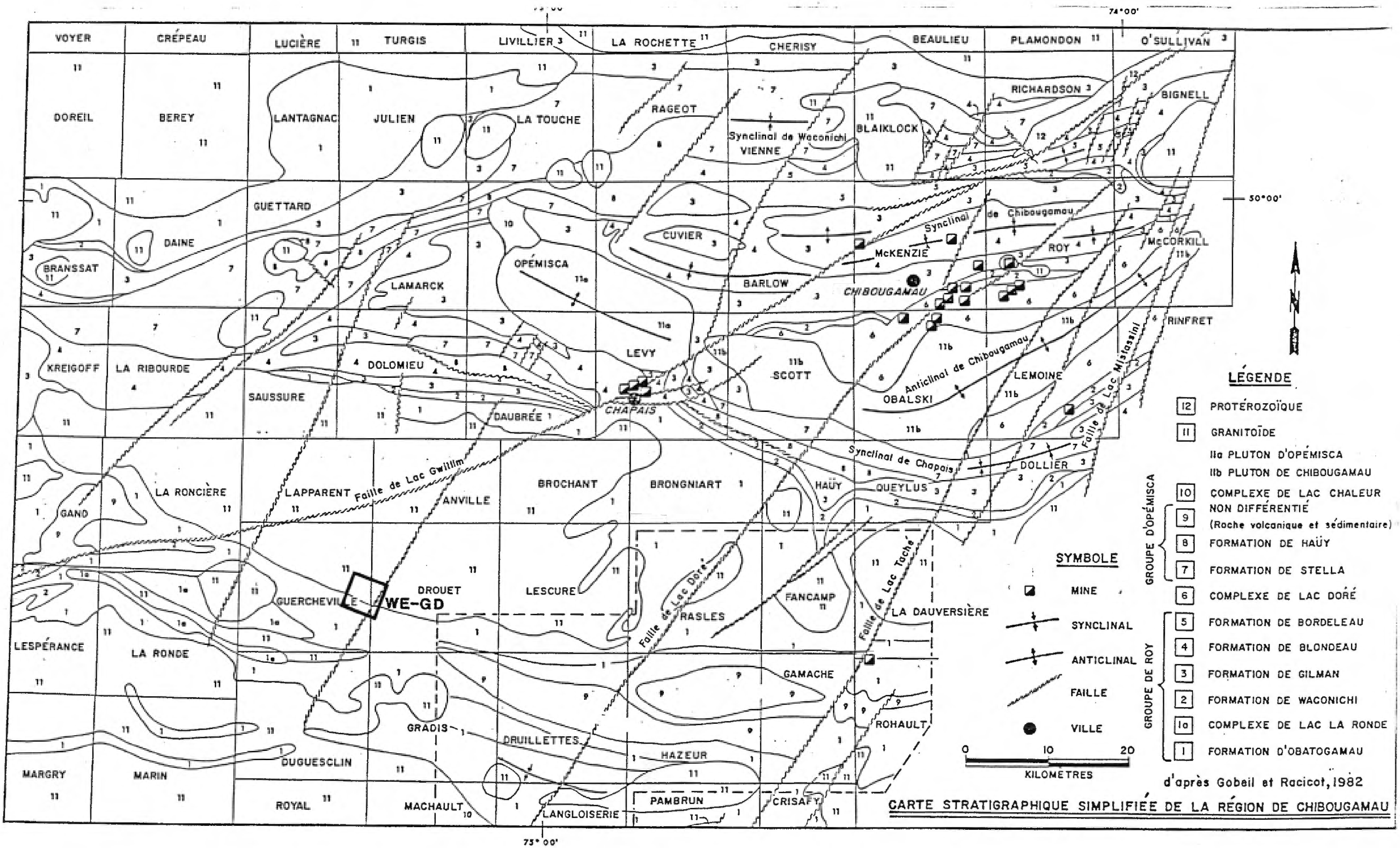

Figure 3: Generalized geological map of the Chibougamau District - after Gobeil and Racicot (1982).