2394

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2394 MAP .....

Geological, geochemical and underground exploration on the Pany, Kom and Natan groups of claims situated on the South bank of the Zymoetz River, Omenica M.D., British Columbia, N.T.S. 103-I
Latitude 54°28'N, Longitude 128°12' and owned by NATIVE MINES LTD. and PECHINEY DEVELOPMENT LTD. on behalf of PECHINEY DEVELOPMENT LTD.

Field work June 1 - September 30, 1969
November 4 - December 17, 1969

Report by

J.P. Nicolet,
Geologist

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ABSTRACT

The work carried out on the Zymoetz Mining Property, Omineca Mining Division, has been performed by MOKTA (Canada) Ltée for PECHINEY DEVELOPMENT LTD., owners and optionners of the claims.

This report has been written in two segments; chapter I including all surface and geochemical work, and chapter II including all underground geological work.

The different surveys performed on the groups of claims have produced the following results:

1. A geological map of the property
2. Discovery of 6 new showings
3. Further definition of limits of mineralization of previously discovered showing (Upper Showing)
4. Accessory data resulting from small localized geochemical surveys

Sulphide copper mineralization has been seen to occur in all zones of strong tectonic disturbances primarily in conjunction with fault zones associated with intrusive bodies.

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CHAPTER I

SURFACE WORK ON THE PROPERTY

1. Introduction

During the period June to September a Pechiney Development Ltd. field crew under the supervision of J. P. Nicolet established a geological map of the property. This was followed by detailed geochemical soil samples and trenches on several claims of the property. These claims are situated 20 miles East of Terrace, on the south bank of the Zymcetz River.

The geological mapping was done from a topographic map established by Spartan and traverses were made every 1,000 feet. Detailed traverses and inspection of outcrops were performed on each main traverse (see plan No 0). The geochemical samples were analyzed for Cu.

This report describes the geology and petrography of the formation encountered and the processing procedure of the geochemical survey and discusses the results of these surveys.

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2. Location and Access

Normal access to the main camp is by logging road east of Terrace for approximately 17 miles. A trail gives a good access to the Upper and Lower Showings. The other showings and claims of the property can only be reached by helicopter and on foot.

The property is 8 square miles and has a roughly square shape. It is bounded to the North by the Zymoetz River, to the West by Mattson Creek, to the South by the edge of Trapline Creek valley and to the East by a line parallel to and 3 miles west of the Clore River (see fig. 1).

3. Claims and Ownership

The located mineral claims herein described form a contiguous block of 114 claims and 6 fractional claims. They have been grouped into 3 claim blocks.

The following table lists claims, groups, and record numbers :

GROUP: NATAN

CLAIM NAME	RECORD NO.
Kelly 3	31700
Kelly 4	31701
Kelly 6	31703
Kelly 7	39825
Kelly 8 - 14 incl.	39826 - 39831 incl.
Kelly 15 - 20 incl.	40226 - 40231 Incl.
Kelly 1	31698
Kelly 2	31699
Native 1	40603
Native 2	40604

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FIG. 1

British Columbia
1967
Approximate Populations of Cities and Towns
Over 25,000
10,000 to 25,000
5,000 to 10,000
2,500 to 5,000
1,000 to 2,500
500 to 1,000
Under 500
Scale of Miles
0 10 20 30 40 50 60
Lambert Conformal Projection
ONE INCH EQUALS ABOUT 31 MILES
1:1,960,000
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PROVINCIAL HIGHWAYS
SECONDARY ROADS
Dual Highways
1st Class (Hard-surfaced)
2nd Class (Gravel or equivalent)
3rd Class (Earth, graded or unimproved)
Projected Roads
RED ROADS. To give maximum clarity to this map a limited network of principal through routes is printed in red. These roads generally carry more through traffic than other main highways shown in dark blue but do not necessarily offer better traveling conditions.
Approximate Mileages
CUMULATIVE
INTERMEDIATE
MILEAGE CHART ON OTHER SIDE FOR DISTANCES BETWEEN PRINCIPAL PLACES
Railway Lines
Summer Steamer Lines
Airline Stops
Government Campsites
Principal Military Airports
Elevations in Feet
ALASKA
Prince Rupert
Terrace
Kitimat
Kitimat Mission
Hazelton
New Hazelton
South Hazelton
Kitwanga
Smithers
Telkwa
Houston
Burns Lake
Francois Lake
Endako
Kemano
Bella Coola
Ocean Falls
Anahim Lake
TWEEDSMUIR PROVINCIAL PARK
PRINCESS ROYAL ISLAND
PITT ISLAND
BANKS ISLAND
HECATE STRAIT
N

GROUP: NATAN

CLAIM NAME	RECORD NO.
Native 3 - 8 incl.	40400 - 40405 incl.
Tan 9 - 16 incl.	44503 - 44510 incl.
Zymoetz No 4 Fr.	45347
Zymoetz No 3 Fr.	45350
Saint No 1	44499
Saint No 2 - 4 incl	44500 - 44502 incl.

GROUP: KOM

Atkom No 1 - 17 incl.	76140 - 76156 incl.
Kelly No 30	45341
Saint No 5 - 16 incl.	45670 - 45681 incl.
Saint No 35 - 44 incl.	45700 - 45709 incl.

GROUP: PANY

Atkom No 18 - 23 incl.	79865 - 79870 incl.
Pan No 1 - 6 incl.	30819 - 30824
Zymoetz No 1	14738
Zymoetz No 2	14739
Zymoetz No 3 - 7 incl.	25531 - 25535 incl.
Zymoetz No 8	30962
Zymoetz No 9	30963
Zymoetz No 10 - 13 incl.	45188 - 45191 incl.
Zymoetz No 14 - 6 Fr. incl.	45344 - 45346 incl.
Zymoetz No 1 Fr.	45348
Zymoetz No 2 Fr.	45349
Zymoetz No 5 Fr.	45351
Kelly No 5	31702
Kelly No 24 - 27 incl.	39945 - 39948 incl.
Kelly No 28	45339
Kelly No 29	45340
Kelly No 31	45342
Kelly No 32	45343

Only the Atkom claims belong to Pechiney Development Ltd. The rest of the claims is registered in the names of Native Mines (Zymoetz, Pan, Kelly, Saint, Native and Tan claims).

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4. General Setting

The Native Mines property and general area has been mapped by S. DUFFELL and J. G. SOUTHER GSC Memoir No 329. It shows sedimentary formation of carboniferous Permien and Triassic age. A volcanic-sedimentary series of Jurassic age has been divided into two groups: the Hazelton Group and the Bowser Group. These formations (sedimentary and volcanic-sedimentary) have been intruded by batholithic stocks and plugs of granodiorite which belong to the Coast Range Intrusion of Cretaceous to Tertiary age

5. Work done on the Property during the Period June - September

The different surveys done by Pechiney are as follows:

1. Mapping and prospecting of the claims. Data reported on a topographic map made by Spartan at a scale of 1" = 1,000 - 1,500', but the the difficulty of the terrain has not allowed us to space our traverses regularly.

   Silt samples were always collected while mapping. (See plan No 0 Itineraries map)

2. Topographic survey and detailed mapping at a scale of 1" = 50' on the Lower and Upper Showing.

3. Geochemical soil sampling on the showing discovered by prospecting.

4. Detailed mapping at a scale of 1" = 20' and 1" = 2' of the new showings.

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5. Trenching of the new showings.

Appendix II and III show the distribution of the personnel and dates worked, and the cost breakdown.

6. Geology

The geology of the property has revealed a thick suite of volcanic and sedimentary rocks belonging to the Hazelton Group which have been affected by a group of intrusions of granodiorite, feldspar porphyry, diorite, granite, and rhyolite. These intrusions are assumed to belong to the Coast Range Intrusions (see plan No 1).

On the field the macroscopic determination of the rocks do not always correspond with their microscopic determinations. In the following text the name of the rocks are used according to their microscopic determinations.

6.1. Petrography and Occurrence of Outcrops

6.1.1. The Volcano-Sedimentary Suite

On the property the rocks of this suite are essentially volcanics with accessory sedimentary formations. Three units have been arbitrarily defined after the predominance of one of the formations of the Hazelton Group;

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however, they cannot be defined as clearly separated stratigraphic units. These three units are described starting at the bottom to the top of the suite.

6.1.1.1. Unit No.1

It is essentially defined by volcanic breccia and agglomerates with minor intercalation of andesites and tuffs. The general colour of the outcrops is middle grey to light grey.

Volcanic breccia and agglomerates

These rocks are composed of fragments of red and grey-green andesite whose diameter varies from a few centimeters in the case of agglomerates up to 10 cm for a breccia. The matrix is medium grained and shows feldspars;ferromagnesians and quartz minerals. This matrix has a grey greenish colour. Feldspars and ferromagnesians are frequently epidotized.

The determinations under the microscope showed that these rocks are of volcanic origin; the matrix is mainly formed by quartz ,epidote, calcite and chlorite in very fine grains. See Appendix VI sample ZA 11.

The grey green andesites and andesite tuff

These rocks are fine grained; grey to green, and are formed of small crystals of feldspars and ferromagnesians with some bigger crystals of amphibole (1mm). They are identical to the grey-green andesite of Unit 2 (see appendix VI sample ZA1 and ZA31 for microscopic determinations).

The red andesites and tuffs

These rocks are homogeneous, fine grained, red to purplish in colour. In some samples needle like crystals of white feldspars and green amphibodes are observable. Their length never exceeds 4 to 5 millimeters . Calcite fills fractures.

The microscopic study has shown euhedral crystals of albite and oligaclase and amygdules of chlorite and epidote. Very fine needles of plagioclase and a red brown dust of hematite compose the matrix of this rock which is an altered andesite (see appendix VI sample ZA2).

Outcrops

The agglomerates form massive outcrops. Their thickness (apparent) is around 30 feet and they are interbedded with red andesites and grey-green andesites whose thickness never exceeds 10 feet.

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Unit 1 has been observed on claim Atkom No 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, Saint No 10, 11, 13, 14, 15, 16, Pan No 2, 4, 6, Kelly No 24, 32.

6.1.1.2. Unit No 2

Unit 2 is characterized by the predominance of andesites and tuff and a minor amount of agglomerates. The general colour of this unit is darker than Unit 1 and more reddish. The following formations have been observed:

Red andesites and red tuffs

On the field these rocks are essentially characterized by a constant red to purplish colour. There are two types:

a) a massive rock; fine grained and fairly siliceous

b) a fine grained rock les siliceous than (a) showing small crystals of white feldspar (2 mm in length) disseminated in the fine grained matrix.

The study in thin section showed that there were andesite and tuffs (see appendix VI sample ZA2, ZA32).

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Grey-green andesites and andesite tuffs

They also are fine grained to massive and exhibit small crystals of feldspars and ferromagnesians. In some places the rock is loaded with hematite which gives a red metallic reflection.

Determination under the microscope has shown epidotized andesites. (see appendix VI sample ZA 33)

The Rhyolitic tuffs

This rock is composed of small crystals of quartz, feldspars and inclusions of red-brown material of volcanic origin. A fine bedding is observable. No thin section has been made as this rock is not common on the field.

The red agglomerates

A great number of rocks of brecciated appearance have been classified under this name. Their grain size is variable but their colour is always red due to a constant amount of fragments of red tuffs. Fragments of grey-green andesitic tuffs are also present in a smaller proportion

than the red tuffs. The fragments of red tuffs are up to 3 inches in diameter while these of andesitic tuffs never exceed $\frac{1}{2}$ inch. All are angular or subangular.

The cement of these agglomerates is red to green; quartz and ferromagnesians. On the field they can be easily distinguished from the agglomerates of Unit 1 as their fragments and matrix are well differentiated.

Outcrops

The grey-green andesite and andesitic tuffs represent the main formation of Unit 2. They form beds of about 100 feet in apparent thickness separated by small beds of red andesites and tuffs (50 feet apparent thickness) and less frequently beds of agglomerates (50 feet apparent thickness). The rhyolitic tuffs outcrop outside of the property, east of claims Saint No 39, 41, 43, while the latter formations as described above outcrop on claim Atkom 1, 2, 3, 4, 5, 11, on Saint 9, 35, 36, 37, 38, 39, 40, 41, 42, 43, Kelly 1, 2, 3, 4, 5, 17, 18, 19, 20, 25, Zym 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 15, Zym fraction 1, 4, 5, Native 1, 2, 8, Pan No 6.

6.1.1.3. Unit No 3

Here the red andesite and tuffs are the predominant formations. However, the characteristic of this unit is the

repetition of different lithological facies, which were not seen in the other units. These facies are described below:

Conglomerate

It is a brownish rock well consolidated; brownish in colour exhibiting fragments of red tuffs, andesites and sometimes rhyolitic tuffs. The size of the fragments varies from 1 mm to 15 cm. Their shapes are rounded or subangular. The cement is composed of detrital fine feldspars and ferromagnesians. This conglomerate has been observed only on one point outside the property. It is in contact with agglomerates of Unit 2 and overlain by red tuffs of Unit 3. Its apparent thickness is about 30 feet. There are no data to assure that this formation is constant at the base of Unit 3.

Brecciated conglomerate

It has only been found in one point outside the property. The rock is formed by rounded elements of tuff whose size does not exceed $\frac{1}{2}$ inch. The matrix is made up of white and pink detrital feldspars. The thickness of the bed is around 2 feet.

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The red andesite and red tuffs

They are always fine grained or even very fine grained and their colour is always red-brownish, but not purple. Small crystals of white euhedral feldspars have been observed as well as crystals of amphibole.

Red agglomerates

They carry essentially elements of red tuff and some element of rhyolitic tuffs. The matrix consists mainly of quartz. The differentiate themselves from the other agglomerates of Unit 1 and 2 by the size of their elements which never reach 1 inch (see appendix VI sample ZA24, 25).

Volcanic sandstone

They have only been observed in Unit 3. They contain fine rounded grains of grey-green andesitic tuffs, red tuffs and white crystals of feldspars. Their size is around 1 millimeter. The rock shows a fine bedding whose beds consist of layers of feldspar and layers of tuffs. The beds have a thickness of 1 to 3 millimeters. A thin section showed that it is probably a bedded tuff (see appendix VI sample ZA23).

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Outcrops

On the field a rapid recurrence has been observed between the different facies as described above; the most frequent facies being the red andesite forming layers of 20 feet (apparent thickness). The volcanic sandstones are interbedded with the ruff and their thickness (true) is about ½ foot to 1 foot.

Unit 3 outcrop on claims Kelly 7, 8, 9, 10, 12, 13, 14, Native 1, 3, 4, 5, 6, 7, 8, Tan 1, 2, 11, 13, 14, 15.

6.1.2. The Intrusives

It has been observed from the regional map (GSC memoir 329) that the Hazelton Group was intruded by batholithes belonging to the Coast Range and of cretaceous age. The volcanic-sedimentary formations of the property show the same type of intrusions.

The grandiorite is the most important and is followed in decreasing frequency by:

- Feldspar porphyries
- Diorite
- Granite
- Rhyolite

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6.1.2.1. Granodiorite

It is a massive medium grained rock whose colour is grey to dark green. On the field it has been called "green granodiorite". It is essentially made of light grey euhedral to subeuhedral plagioclase whose size is around 2 - 3 mm, pyroxene, amphibole and chlorite form needle-like crystals. Magnetite is generally present. A thin section has shown the presence of K-feldspars.

Another variety of granodiorite that has been called "pink granodiorite" is also present on the field. It is a light green rock with numerous pink feldspars.

A thin section revealed that the pink feldspars were K-feldspar with a very fine dust of hematite.

Microscopic studies have shown that the pink granodiorite could be a quartz monzonite in the case of the Lower Showing and a diorite in the case of the Chicken Showing, however, as there is not enough data, the term "pink granodiorite" has been used.

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Outcrops

The green granodiorite outcrops on the North part of the property to form a batholith of about one square mile. The following claims are included: Saint 36, 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 14, 36, Kelly 27, 28, 29, 30, 31, Zymoetz 1, 2, 8, 10, 12, 13, 14, Zymoetz Fraction 6.

The "pink granodiorite" can be found in two places:

a) in the Lower Showing it forms a small lense on claim Zymoetz no.2.

b) Inside the batholith of green granodiorite on claims Saint no.2, 5, 6, 8, 11, 13, Kelly 30, 28, 29.

6.1.2.2. The Feldspar porphyry

It is greenish grey rock exhibiting big elongated phenocrysts of white and yellowish feldspar (1 inch long) in a dark green matrix composed of fine grained feldspars and chlorite.

A detailed study of the different outcrops found in the field has shown a certain variety in the composition of these porphyries. Amygdules and patches of fine chlorites and amphiboles are observable in some places as well as round

shaped phenocrysts of quartz. Microscopic studies have revealed that these porphyries are on andesitic composition. (see appendix VI sample No ZA7, ZA12, ZA13)

Outcrops

The feldspar porphyries form long sills interbedded in the volcanic rocks of Unit 2; their thickness varies from 20 feet to 300 - 400 feet. The longest sill has been followed on the field for 3.000 feet. No metamorphic contact has been observed.

Feldspar porphyries outcrop on claims: Zymoetz 1, 2, Zymoetz fraction 4, Kelly 1, 3, 5, 17, 20, Saint 35, 37, Atkom 1, 11, T n 13, Native 3, 4, 5.

6.1.2.3. Diorite

It is a green fine grained rock composed of equal proportions of feldspars and ferromagnesians. Biotite is also present in small amounts.

This formation has been observed on two parts of the property:

a) on the North West of the property where it forms a small lense trending East-West, 5.000 feet long and 1.000 feet wide.

b) On the Upper and Lower Showing where it seems that the diorite has intruded the feldspar porphyry.

Sample ZA6 and ZA19 have been microscopically determined. (see appendix VI)

Diorite outcrops on claims Atkom 19, 20, 22, Zymoetz 2.

6.1.2.4. GRANITE

It is a light grey to pink, medium grained rock that is formed mainly by quartz and feldspars (orthoclase, and plagioclase) and some ferromagnesians.

The granite forms small intrusive bodies outcropping on the South and West of the property. (claimsAtkom 7, 8, Saint 13, 15, 43)

6.1.2.5. RHYOLITE

It is a fine grained, light beige, almost white rock, essentially made of quartz and feldspar. It forms dikes and small lenses cutting into the volcanic rocks of Unit 2. Most of the outcrops seen are outside the property.

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A thin section has shown that the amount of quartz is higher than the amount of feldspar.

Discussion on the chronological classification of the different intrusions

It is very difficult to determine exactly the age relation of the different intrusives because of the small number of contact observed on the field, and only the interpretation of the map gives some data about this age relation.

a) The granodiorite is probably the oldest intrusive.

b) At the Upper-Lower Showings the feldspar porphyry seems to intrude the granodiorite.

c) The diorite is related to the other intrusives only in the Upper-Lower Showing. So far only one contact between feldspar porphyry and diorite has been observed. Therefore it is not possible to make any definite statement about ages, however, the feldspar porphyry is very often strongly epidotized while the diorite is always fresh looking. This could suggest that the diorite could be younger than the porphyry.

Finally the examination of the geological map in the Southwest part of the granodiorite batholith could

suggest that the granite is younger than the granodiorite but older than the porphyry.

d) The age of the rhyolite dikes remains to be determined.

The chronology of the intrusives could be as follows, from the oldest to the youngest:

granodiorite
granite
porphyry
diorite
rhyolite ?

6.1.3. STRUCTURAL GEOLOGY (see plan no. 1A)

6.1.3.1. Photogeology

A photogeological study has pointed out different formations composed of hard and medium hard rocks. The trend of these formations is generally North-South and they dip to the East. The photogeology indicated that they were a monotonous volcanic or sedimentary series. Observations in the field have proven that these formations were volcanic and sedimentary belonging to the Hazelton Group.

The subcircular shape observed in photogeology was attributed to plugs of diorite intruding the granodiorite

of the Hazelton Group. It has just been possible to confirm this observation on the field. However, in most of the cases, these subcircular shapes correspond to intrusions of granite, granodiorite and diorite. Photogeological studies have therefore been slightly inaccurate about the determination of intrusive bodies, however, it has defined very well the faults of the property and most of them were observed in the field.

6.1.3.2. STRIKE AND DIP OF THE FORMATIONS

Field observations have shown a North-South striking of the Hazelton Group on almost all the property, but on the South-West part, where the rocks of Unit 1 trend NW-SE. The dip of these formations can easily be spotted in the SE part of the property; it varies from 50 to 70° to the SW. In the NW part the formations dip West and South-West. Some abnormal dip and strike have been made out around the faults.

6.1.3.3THE FAULTS

It has been possible to see on the field in several points the faults pointed out by photogeology. They have been grouped as follows:

1) NS to NNW-SSE Faults

They have been seen East of the Mattson Creek and in the Kelly Creek. The fault parallel to the Mattson Creek outcrops in the creeks D2 and D3. The fault is represented by a zone of intense shearing and fracture, 2-3 feet thick in the agglomerates of Unit 1. In the Chicken Showing this fault has not been recognized clearly, though it can be traced for about 2 miles in its south half.

Several faults East and West of the main fault have been observed in photogeology and sometimes on the field. A NS fault was seen on the right bank of Kelly Creek, separating a sill of feldspar porphyry and the andesites of Unit 3.

2. NW-SE faults

They are located in the Southeast portion of the property and in the Upper and Lower Showing. The most important ones are:

a) The Goat Bluff fault which is marked in the topography by a cliff 200 - 300 feet high and can be seen in the Goat Bluff Creek. This fault dips steeply to the SE.

b) In the Creek D2 of Kelly Creek a fault affects Units 2 and 3. Shearing and tectonic breccia have been observed.

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The property would be located on a great anticline whose axis would be approximately NS. The West side of this anticline would be affected by NNW-SSE faults in its South-Western part and by a NNE-SSW fault in its North-Western part. These faults would uplift a Western block that is older than the formation located East of the faults. It can be assumed that these faults are reverse faults.

The ENE--WSW fault is another phenomenon to be noticed. It would have cut the axis of the anticline and displaced westward its southern part.

Cross section AA' shows that the west side of the anticline (Unit 1) has been uplifted. From West to East the formations of Unit 1 dip West up to Kelly Creek and on its possible right bank the formations of Unit 2 dip East. This could suggest that the heart or the center of the anticline could be around Kelly Creek. The east side of the anticline is made of formations of Unit 3 which show a minor syncline fold.

Cross section BB' shows from West to East the batholith of granodiorite and a part of the formation of Unit 2. The presumed center of the anticline has been intruded by feldspar porphyries and granodiorites.

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c) The Mountain Goat fault has been spotted in three places: in the intrusion of porphyry (southern limit of the property); near the granite intrusion and the andesite of Unit 2. At this place a clay-breccia filling of about 3 feet thickness has been observed. In the Mountain Goat Showing numerous fractures and shears were seen in the andesites of Unit 2.

d) In the Lower Showing two subparallel faults are located in the granodiorite; they show a brecciated and altered zone of 2-3 feet thick.

3) NE-SW faults

A fault of this direction is located in the northern part of the property; it separates the agglomerates of Unit 1 and the tuffs and andesites of Unit 2.

4) ENE-WSW faults

Only one fault of this trend has been observed in photogeology but it was not observed in the field. This fault is located in the Creek G3 of Mattson Creek and G2 of Kelly Creek.

6.1.3.4. Tectonic Interpretation

The examination of the geological map shows a complex structure affected by numerous faults. The following hypothesis has been made to explain the field observations:

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Cross section CC' also shows the intrusion of the granodiorite. The anticline shape is not observable and it is along this section that the EN - WSW fault is located.

Cross section DD' indicates again that Unit 1 has been uplifted. Once more the shape of the anticline is not observable and has therefore been interpreted.

Finally, cross section EE' shows the same structure than DD', though the formations have a more NNW direction.

This interpretation of anticline is the simplest but does not solve all the tectonic problems of the property.

The age of the fault intrusions is still not quite clear. It has been suggested that the formations of the Hazelton Group would have been folded before the intrusions which would penetrate the zones of weakness created by the faults. It is also suggested that the great faults were active during and after the folding and intrusive times.

J.P. Nicolet, Geol.

6.2. GEOCHEMISTRY (see plan no 1B)

A geochemical survey (silt sampling) was done in conjunction with the mapping. Each time it was possible, silt were collected in streams and creeks.

The lack of regularity in the collection of the silt is due to the frequent absence of alluvium.. We were, however, able to spot some anomalous zones whose Cu value is about twice the background. The geochemical background is around 50 ppm.

This small geochemical survey was only a test although it provided us with some valuable data.

J.P. Nicolet, Geol.

6.3. DESCRIPTION OF THE SHOWINGS

Six new showings were found through prospecting and they are the following:

Mountain Goat Showing

Stephen Showing

Mike Showing

"Zone faillée"

Chicken Showing

Calona Showing

Three old showings have also been reexamined and they are:

The Lower and Upper Showing

The East Side Showing

The Goat Bluff Showing

A variety of work has been done on these showings and it is described below:

6.3.1. THE LOWER AND UPPER SHOWINGS (see plan No 2)

They are located on the Left bank of Kelly Creek in the northern part of the property, partially in the granodiorite and partially in the Hazelton Group of rocks.

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The surveys done on these showings consist of a topographic survey and mapping survey, both at a scale of 1" = 50', and finally an underground exploration program (adit and cross-cut). The underground exploration program will be described in another chapter.

6.3.1.1. Mapping Survey

The mapping done on the topographic map previously established was done at a scale of 1" = 50' and has shown volcanic rocks and intrusive rocks.

The volcanic rocks belong to Unit 2 already described and they are:

Grey-green andesite and tuff
Rhyolitic tuffs
Red andesites and tuff
Agglomerates

On the field it has not been possible to follow in detail the stratigraphic succession of these rocks, although we might have the following stratigraphic succession from West to East.

Andesites and andesitic tuffs
Rhyolitic tuff
Andesite and andesitic tuff
Red tuff and red andesite
Andesite and andesitic tuff
Rhyolitic tuffs
Agglomerates
Red tuffs

These formations have been penetrated by the following intrusinns:

a) The granodiorite which presents two types:

A green granodiorite and a pink granodiorite.

(See appendix VI, microscopic determination sample No. ZA 16; ZA 17; ZA 18.)

b) The feldspar porphyry already described above.

(See appendix VI's Samples ZA 12; ZA 13)

c) The diorite is a slightly magnetic rock.

(See appendix VI, sample ZA 19.)

d) The rhyolite porphyry is a five grained rock, grey to pinkish beige, exhibiting small phenocrysts of quartz and feldspars in five grained matrix.

(See appendix VI, sample ZA 15)

6.3.1.2. Tectonics

Volcanic Rocks

An intense faulting obliterated strongly the trend and dip of the volcanic formations, however South of the Upper and Lower showings the formations strike N-S and dip from 50^{o} - 70^{o} to the West.

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Intrusives

The green granodiorite intrude the volcanic rocks and outcrops on almost all the Lower Showing, and above the Upper Showing the "pink granodiorite" form an E.W. lense at the Lower Showing.

The feldspar porphyry seems to intrude the granodiorite in the Lower Showing as well as the volcanic rocks in the Upper Showing. Therefore, the feldspar porphyry formsa dike or plug but not a sill as it is usually the case on the property. The diorite forms two plugs in the porphyries on the Lower Showing.

The rhyolite porphyry consists of small dikes 1 - 5 feet thick, forming small outcrops in the Lower and Upper Showing. They have intruded both volcanic rocks and granodiorite.

Faults

Various vaults have been observed on the field. Their thickness vary from 1 - 3 feet. They were seen in all types of rocks but never for long distances. We can suggest that they are post intrusive in age and that they are of two different ages. The rhyolitic porphyry was seen in faults and it has also been observed West of the Upper Showing a dike of porphyry slightly displaced by a fault, therefore we could have a first tectonic movement with intrusion of

porphyry and a second one with displacement of porphyry.

The faults have been grouped in three families without distinguishing their age:

a) The East-West faults to the South

b) The Northeast - Southwest faults dipping Southeast

c) The Northwest - Southeast faults dipping Southwest

The observation of numerous crushed and fractured zones in the former drill cores of Native Mines prove that there are many other faults which were not observable on the field.

The mineralizations

The mineralizations of the Upper and Lower Showings consist of chalcopyrite, bornite and probably chalcosine.

In the Lower Showing the mineralization appears in the sheared zones of the prink granodiorite. Chalcopyrite was observed in fine grains around the sheared zones and in fracture fillings. The mineralized zone is about 500 feet long and 50 feet wide. The assays of the Native Mines trenches have indicated an average grade of 0.4 % Cu. In the Upper

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Showing the mineralization is localized in the sheared zones of the volcanic rocks and the porphyry. Chalcopyrite and bornite form big patches (1 - 5 mm diameter) and veinlets around the sheared zones. This mineralization was observed in the Central and West part of the showing, while in the East part it seems to disappear, although the shears are still present.

Further field observation has pointed that the bornite and chalcopyrite was more abundant in the agglomerates than any of the rock type of the Upper Showing.

6.3.2. Goat Bluff

This showing was discovered by Native Mines and is located in a cliff on the East part of the property, along the big fault observed in photogeology and on the field.

The formations are red andesites, grey-green andesitic ruffs and rhyolitic tuffs belonging to Unit 2.

It was not possible to climb in the wall to observe the mineralization in place, however, boulders observed at the foot of the cliff show chalcopyrite and bornite in fine grains disseminated in the red andesites and the grey-green andesites.

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6.3.3. The East Side Showing (see plan No 7)

This showing was discovered by Native Mines and is located on the right bank of Kelly Creek at the same elevation as the Upper Showing. It is located in the grey-green andesites and the red tuff of Unit 2. A detail mapping survey and the enlargement of the trenches are the works above on this showing.

The geological mapping (see plan No 7) was done at a scale of 1" = 20' and has shown a small batholith of granodiorite intruding andesites and red tuffs. The North part of the showing shows agglomerates and red andesites. Dikes of rhyolitic porphyry intrude these formations.

Tectonic

The red andesites have a North-South direction and dip 70° to the East. The andesite - granodiorite contact was not observed because of the overburden.

Two familiar faults have been observed:

a) Faults with a NNE - SSW direction dipping to the NW or vertical

b) Faults of EW direction dipping to the South or vertical

Two faults have been interpreted:

One has a NNE - SSW direction, the other a EW direction. These faults limit a wedge of andesite in the granodiorite.

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The Trench (see plan N. 7A)

It was opened for over a length of 64 feet and discovered red andesites and red silicified andesites. The contact of these two formations is faulted.

Mineralization

In the field chalcopyrite and bornite were observed in the red andesites and the grey-green andesites.

Trenches have confirmed these sulfides and have shown that they occur essentially in the red silificied andesites.

The following table gives the channel sample results of the assays for copper, silver, and gold.

Trench	length of mineralization	Cu %	Ag Oz/t	Au Oz/t
Mokta	13'	0.06	0.1	tr.
	16'3"	0.12	0.2	tr.
	14'	0.17	0.1	tr.
	13'5"	0.39	0.1	tr.
	15'4"	0.70	0.3	tr.
Native Mines	9'	0.31	0.4	tr.

6.3.4. The Mountain Goat Showing (see plan 4)

Location

This showing is located in the South and Central part of the property at elevation 4,000' and in the red andesites and grey-green tuffs of Unit 2.

This showing has been discovered along the Creek D2 tributary of Mattson Creek.

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Work done:

They consist in:

- Rock-Prospecting
- Soil-Geochemistry
- Detailed geological mapping
- Trenches

Rock Prospecting

Malachite, bornite, chalcopyrite and chalcocite have been found in red silicified andesites by rock prospecting. This mineralization is irregularly disseminated in the rock and appears mainly in the left bank of the creek. Its extension is about 130 feet. Bornite and malachite have been found 1,100 feet South of the creek.

Soil Geochemistry (see plan No 4C)

Soil samples have been collected around the showing on a grid 1,400 feet long in a East - West direction and 2,000 feet long in a North - South direction. Soil samples have been collected every 100 feet on lines 200 feet apart. A total of 220 samples have been analysed for CU. 180 samples have been picked up at a depth of 3 feet and 40 at a depth of five to six feet.

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The results of the analysis show a background around 35 ppm. A population of about 10 values vary between 70 and 150 ppm to form a small anomaly 1,000 feet South of the Mountain Goat Showing. Six other values are above 160 ppm but are isolated and do not form an anomaly.

Detailed Mapping

Silicified red andesites have been observed on the field. The silicification seems to be more important in the immediate vicinity of a dike of micro-syenite (see appendix VI sample ZA8).

An intrusion of feldspar porphyry outcrops in the West part of the showing (see appendix VI, sample ZA7).

Tectonic

The red andesites seem to have a NS direction and dip to the East while the microsyenite shows an East - West direction and dip 80° to the South.

Three faults have been observed in the showing: they have a NE-SW, NW-SE and EW direction. The NE-SW fault has moved the syenite dike 10 feet to the South.

A strong shearing zone appears in the microsyenite whose direction is EW and dip 50° - 60° to the South.

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Trenches (see plan No 4A, 4B)

Two trenches have been opened perpendicular to the strike of the syenite dike and on the South bank of the Creek.

Trench No 1 has been opened on a length of 88' and has shown 2 sections of red andesites of 8 and 15 feet in length.

Trench No 2 was opened on 28 feet and showed red andesites for 14 feet. Two faults are located in these works and numerous fractures are also observable.

The third trench was opened in the samll geochemical anomaly. This trench has an EW direction and is 35 feet long, and the rocks observed are red andesites with some small phenocrysts of feldspars. This formation dips 69° to the East and strikes North - South.

Mineralization

The mineralization consists of fine grained chalcopyrite and bornite and some chalcosine disseminated in red andesites and their fractures.

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The trenches did not show an important mineralization and thus this showing is not of high potential.

The following table gives the results of the assays made on channel samples of the trenches.

Trench No.	length of mineralization	Cu%	Ag Oz/t	Au Oz/t
1	5'	0.14	0.2	tr.
	3'5"	0.06	0.3	tr.
	3'5"	0.05	0.3	tr.
	5'	0.03	0.2	tr.
	3'5"	0.06	0.2	tr.
2	6'	0.05	0.1	tr.
	6'	0.05	0.1	tr.
	6'	0.18	0.2	tr.
	7'	0.11	0.2	tr.
tr. "geoch."	10'	0.14	0.3	tr.
	8'	0.17	0.3	tr.
	5'	0.35	0.5	0.07

6.3.5. "La zone faillee" (The sheared zone)

A sheared zone is located in the south part of the property and presents numerous malachite stainings. A trench was opened over a lenght of 40 feet in an ENE - WSW direction (see plan no. 8) and has shown red andesites to the East and grey-green andesites to the West.

A NE-SW fault dipping 75° West separates the two formations. Other faults dipping 60-85° to the East and striking NE - SW have also been observed. Numerous fractured and broken zones are present. Chalcopyrite and bornite occur in

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fine grains in the red andesites and grey-green andesites.

Channel sampling has been done in the trench and the results of the assays are given below:

Channel length	Cu%	Ag Oz/t	Au Oz/t
10'5"	0.12	0.1	tr
6'5"	0.82	0.7	0.01
10'	0.13	tr.	tr.
10'	0.03	tr.	tr.

6.3.6. The Mike Showing (see plan No 6)

This showing is located along the D1 tributary creek of the Mattson Creek on the South - West part of the property and in the agglomerates and andesites of Unit 1. Patches of chalcopyrite have been found by prospecting in the agglomerates.

Mapping

Mapping was done at a scale of 1" = 20' and shows grey-green andesites and agglomerates intruded by a plug of granite to the south.

The agglomerates are grey-greenish and present fragments of andesites whose size does not exceed 1 inch. They are very hard and interbedded with andesitic tuffs.

The formations dip regularly 40 - 60° to the SSW.

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Several faults were observed and they strike NS, EW and NNW - SSE and are vertical or subvertical. The NS fault moves the agglomerates and tuffs towards the North while the NNW - SSE seems to have moved granite and agglomerates to the South.

Trenches

Two trenches have been opened; they did not discover any mineralization. Blasting of trench No 1 has cleared out completely the mineralization found by prospecting.

Trench No 2 did not reveal any suphides.

The field observations have shown that patches of chalcopyrite are located in epidotized agglomerates over widths not exceeding 12 inches. A sampling done before blasting trench No 1 has shown the following copper values:

Width	Rock Type	% Cu	Ag Oz/t	Au Oz/t
2"	Agglomerates	0.47	0.3	tr.
12"	Tuffs	0.03	0.2	tr.
4"	Agglomerate	0.92	0.3	0.02

No other mineralizations were found on this showing. No further work will be accomplished.

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6.3.7. The Stephen Showing

This showing is located in a cliff on the left bank of creek D2 (tributary of Mattson Creek) at elevation 1500'.

Agglomerates and andesitic tuffs of Unit 1 outcrop in and around this showing. Rock prospecting discovered a small bed of andesitic tuffs that present small grains of chalcopyrite disseminated in the tuffs. The thickness of the bed is around 3 feet and mineralization has been for about 3 feet in length.

The agglomerates are not mineralized. However, major faults in the vicinity of this showing could justify a more detailed extension of prospecting.

6.3.8. The Chicken Showing (see plan No 3)

Location

The Chicken Showing lies to the North-West of the property, in the large stock of green granodiorite and more particularly inside the pink granodiorite.Its elevation is 2,300 feet. It was discovered by prospecting along the D4, tributary creek of Mattson Creek.

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Work done:

It is summarized as follows:

- Rock prospecting
- Soil geochemistry
- Detailed geological mapping
- Trenching

Rock Prospecting

As mentioned before, there are small amounts of malachite and azurite along the creek D4. Some chalcopyrite and bornite appear in the fresh rock which is a pink granodiorite.

Mineralization has been observed especially on the South side of the creek over a distance of about 100 feet. 350 feet West of this showing very light traces of malachite and chalcopyrite have been found in the same pink granodiorite.

Soil Geochemistry (see map No 3B)

Geochemical soil sampling has been carried out around the showing. The survey covered a rectangle of 1,600 feet E-W and 2,000 feet N-S. Samples were taken every 200 feet on N-S lines being 400 feet apart.

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63 samples were taken at a depth varying from 2 to 3 feet. The results of the analysis show a background of about 10 ppm. Only 4 values were over 40 ppm and, therefore, it is not possible to speak of an anomaly.

Detailed Geological Mapping

The mapping has confirmed the presence of pink granodiorite which is medium grained. A thin section showed that this rock has a dioritic composition. The pink colour of the feldspar could be due to a very fine dust of hematite (see appendix VI, sample ZA20).

Some dikes have been observed within the "pink granodiorite". This rock has a brownish colour and shows small phenocrysts of feldspars in a chlorite and feldspar matrix. A study in thin section has indicated that this rock is of andesitic composition (see appendix VI, sample Z4-21).

A dike of porphyritic granodiorite exhibiting numerous phenocrysts of feldspars and quartz and some ferromagnesians was observed in trenches No 1 and No 2. Small dikes of light grey rhyolite are intruding the granodiorite.

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Tectonics

The large NS fault visible in photogeology and found in the creeks D2 and D3 of Mattson Creek has not been observed in the showing. Only minor NS faults have been observed in the trench No 4.

The major fault of the showing is an EW fault.

Trenches (see plan No 3A)

Six trenches have been opened perpendicular to the EW faults. They are never very long because of the thickness of the overburden.

Trench No 1 does not show any mineralization and is not of any interest.

Trenches No 2, 3 and 4 show several faults in the granodiorite and the dike of andesite. They are mineralized in copper sulfides.

Trench No 5 shows a pink granodiorite slightly mineralized and trench No 6 does not reach the bedrock.

Mineralization

It consists mainly of chalcopyrite and a little bornite as well as some malachite.

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Chalcopyrite and bornite are disseminated and fill fractures in the pink granodiorite. Abundant fine grains of chalcopyrite were observed in the dike of andesite.

The best mineralization was found in trench No 4. It consists of patches (3 - 8 mm in diameter) and very fine veinlets of chalcopyrite located in the pink granodiorite.

Examination of the Cu value of table 1 shows that the mineralization is discontinuous in the pink granodiorite as well as in the andesite dike.

Table 1

Trench No.	Length of mineralized sections	Assay values Cu %	Ag Oz/t	Au Oz/t
1	nil			
2	4'	0.10	0.1	tr.
	4'	0.18	0.1	0.01
	5.5'	0.20	-	-
3	6'	0.04	tr.	tr.
	8.7'	0.35	0.2	0.01
	3.3'	1.21	1.2	0.01
	3'	0.14	0.1	tr.
	7'	0.21	0.1	tr.
	6'	0.98	2.9	0.01
4	7.5'	0.25	-	-
	7'	3.38	0.9	0.01
	6.4'	0.95	1.1	tr.
	2.6'	1.42	1.3	0.01
5	8'	0.27	-	-

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6.3.9. The Calona Showing (see plan No 5)

This showing is located on the Northwest part of the property. Its altitude is 1,800 feet and a logging road gives easy access to it.

Rock prospecting showed malachite, chalcopyrite, and pyrite in a very hard agglomerate. Mineralization was observed on four outcrops over a distance of 150 feet.

A detail mapping survey revealed an agglomerate of green-yellow colour with fragments of andesite in a matrix made of feldspar and amphiboles. This matrix is heavily epidotized. Dikes of diorite cut the agglomerate.

It has not been possible to observe a strike and a dip in the agglomerate. The dikes of diorite have an EW direction and dip to the South and to the North.

Very minor faults have been observed on this showing.

Trenches (see plan No 5A and plan No 5B)

Four trenches were opened on this showing. Trench No 1 is 80 feet long whereas the other three trenches do not exceed 20 feet.

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In trench No 1 some patches of chalcopyrite and bornite have been found over 14 feet in the North part of the trench.

Trench No 2, 3 and 4 did not show the mineralized zone found by prospecting.

Mineralization did not show any significant value after the opening of the trenches. Table 2 shows the values in copper found in the trenches.

Table 2

Trench No	Length of mineralized sections	Assay values Cu %	Ag Oz/t	Au Oz/t
1	14'	0.05	0.1	tr.
3	12'	0.05	tr.	tr.

7. Conclusion

The mapping of the property and the discovery of several showings as well as the revision of the work done by Native Mines enable the formulation of several hyphotheses and, consequently, a conclusion.

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The mapping has shown an extreme complexity in the stratigraphy, the tectonics and the metallogeny of the property.

The stratigraphy of the Hazelton Group is not simple and the divisions made in this group are arbitrary. They are based on the predominance of one formation on the other.

The intrusive rocks have contributed to the complexity of the tectonics.

Tectonics and intrusives have, without doubt, played a big role for the mineralized zones of the country. As it has been observed, the old and new showings are always close or associated with zones of intense shearing and faulting. On the other hand, the mineralized zones are also associated with intrusive bodies (porphyry, diorite, granodiorite).

Three hyphotheses about the origin of the mineralization can be formulated:

A) Mineralization would be post-intrusive

After an intense shearing, fracturing and faulting period which would affect both intrusive and volcanic rocks, a series of alterations would have taken place (epidotization silicification) followed by the mineralization filling

the fractured zones. The sulphides would be a late manifestation of an already solidified magma. Hence, we would have the following succession of events :

a) folding and fracturing of the volcanic rocks

b) intrusions in the zones of weakness and solidification of the intrusions

c) second stage of fracturing affecting every rock

d) hydrothermal solution along the fractures causing the alteration and carrying the mineralization

Such a mineralization is observed in the Upper Showing and East Side Showing.

B) The magma penetrating the volcanic rocks would be mineralized

We would have the following succession of events:

a) folding and fracturing of the volcanic rocks

b) intrusion of a magma containing suphides; solidification

c) second fracturing, alteration and partial remobilization of sulphides with concentration along the faults. Some disseminated sulphides are still observed in the intrusive rocks.

The Chicken Showing could support this hypothesis.

C) The sulphides would have been located in the volcanic rocks and remobilized during the intrusion of granodiorite

The presence of a greater amount of sulphides in the agglomerate of the Upper Showing might be in favour of this hypothesis. However, there is little evidence

since only the fractured agglomerates are mineralized. Non-fractured agglomerates found on the property are not mineralized.

As a conclusion we can say that hypotheses A and B are the most valuable for the type of mineralizations observed in the Upper and the Chicken Showing.

CHAPTER II

DEVELOPMENT WORK ON THE UPPER SHOWING

1. Introduction

As 16 holes were drilled by Native Mines in the period 1966 - 1967 on the Upper Showing, additional drilling would not contribute to the actual knowledge of this showing. However, the interesting results of the copper values convinced the company to have an exploratory adit and cross-cut driven through the showing.

2. Mining Methods

The adit and cross-cut are 7 feet high and 6 feet wide. The work began on November 4th, 1969 and ended on the 17th of December 1969.

During the first part of November three shifts of 2 men worked on a 24 hour basis. During the second part

of November and all December there were two 10 hour shifts per day.

Table I shows the different averages of advancement throughout all shifts.

Table I

	Total footage advance	No of shifts	Average advance per shift	No of working days	Average advance per day
3-8 hour shift per day	533'	62	8.5'		
2-10 hour shift per day	531'	31	14.3'		
1-10 hour shift per day	24'	2	12		
T o t a l	1088'	101	10.7'	43	25.3'

Sampling

The sampling was done by 2 technicians and one helper, supervised periodically by the geologist.

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The sampling consisted of:

a) Recovering sludge from 5 holes out of 28 - 30 drilled into each face

b) Horizontal channel sampling from continuous 3 foot sections

c) Vertical channel sampling (6 feet long) with a separation of six feet. This sampling was carried out only in the case of abundant mineralization.

d) Muck sampling in the mineralized zones

A small sample room comprising a little crusher, a dryer and a splitter was on the mine.

Topographical and geological mapping were carried out on a daily basis.

3. Situation of Adit and Cross-Cut (see plan No 2 2 3 A)

The adit was first driven parallel to Lorsa Creek. Then it described a broad curve to the West underneath Lorsa Creek. This adit is 569 feet long.

Cross-cut G1, a continuation of the adit, was driven in an eastward direction. It follows the mineralization for about 200 feet and is 281 feet long. In the middle of G1 another cross-cut G2 was pushed South for 149 feet. This cross-cut explored the horizontal extension of the mineralized zone and established a drilling station for further investigations downwards.

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4 Results

4.1. Description of the different geological formations (see plan N° 223 Bure C)

Essentially there are two types of formations:

a) Feldspar porphyry (andesitic composition) for 480' in the adit

b) Volcanic rocks of the Hazelton Group which were observed in G1 and G2

The feldspar porphyry has already been described in the first chapter of this report. A very constant mineralogical composition has been observed. Also a variation in the size of the phenocrysts of feldspars (4 mm to 3 cm) has been noticed with a strong alteration of these phenocrysts. These phenocrysts are partially or completely replaced by epidote.

The rocks of the Hazelton Group are extremely varied and almost every formation is in faulted contact with its neighbour.

While mapping the cross-cut we observed six types of rocks. They are:

a) Grey agglomerate

This is a grey-green rock showing fragments made of plagioclase, epidote and chlorite. The matrix shows fine grains of quartz, feldspar and chlorite.

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b) Green-brown agglomerate

This rock shows angular fragments of red tuff, rhyolitic tuff, phenocrysts of quartz and epidotized feldspars. The matrix is made of fine grained feldspar quartz and chlorite. This rock is well mineralized in chalcopyrite.

c) Pink rhyolitic tuff

This rock is characterized by its colour and a very fine bedding. These features are caused by fine felsic minerals surrounding quartz-feldspathic fragments. The size of the fragments vary from 1 mm to 5 mm.

Very fine grains of pyrite are the only mineralization observed in this rock.

d) Yellow rhyolitic tuff

It has been called yellow, because of long yellowish lenses of quartz-feldspathic material. Chalcopyrite forms very fine grains which are disseminated in the rock. Bornite can be seen in microfractures.

e) Andesites

These rocks are dark grey to red and form sills or dikes in the rhyolitic tuffs. No mineralization has been observed.

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f) Breccia

This rock is composed of fragments of rhyolites and is probably tectonic in origin. The fragments are cemented together by quartz, calcite, sericite and chlorite. Copper mineralization has been observed in these breccia.

g) Red tuff

This rock is very fine grained, red or green-red in colour. It is composed of feldspar, ferromagnesian and chlorite.

4.2. Tectonics

Map No 223 B and C illustrate the great complexity of the tectonics. Faults in every direction are numerous. They have been grouped as follows:

- Faults striking NW dipping NE or SW
- Faults striking NE dipping SE or NW
- Faults striking EW dipping South
- Faults striking NS dipping East and West

Faults have different appearances depending on the type of rock they cut.

We have observed:

a) A clay breccia material with broken walls in the porphyry and in the agglomerate.

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b) A strong shearing and fracturation in the andesite and red tuff with calcite and quartz fillings.

c) Fracturing and microfracturing in the breccia with calcite and bornite filling

It seems that these different faults have divided the Upper Showing into different uplifted blocks. This strong faulting and shearing observed in the showing is probably due to its location at the nose of the latholith of granodiorite and its location on the anticline of Kelly Creek.

4.3. Mineralization

The mineralization consists essentially of chalcopyrite, bornite and a little pyrite. A microscopic study has shown very fine crystals of galena and magnetite.

The observations made in the adit and cross-cuts show that the mineralization is disseminated in the agglomerates, in the rhyolitic tuffs and is filling the fractured and sheared zones of these rocks. It has also been observed that the big faults separating the different formations are not frequently mineralized. The adjacent porphyry is only weakly mineralized.

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Alterations are abundant in the adit and cross-cuts. They consist of epidotization, sericitization, chloritization and silicification.

A relation exists between the alterations and the mineralization. Epidote is especially abundant in the feldspar porphyry, whereas there is little associated chalcopyrite and bornite. This epidote alteration can be used as a regional guide.

Chloritization, sericitization and silicification seem to have a close relationship with the mineralization. The disseminated chalcopyrite and bornite are always related with abundant chlorite. The bornite and chalcopyrite in microfractures and sheared zones are related to the quartz and sericite.

Table II shows the copper assay values for the adit and the cross-cuts. Table III summarizes the value in Cu, Ag, and Au.

Layouts No 223D, E, F, G, and H were interpreted from the drill logs of Native Mines and our own compilations. It shows that the mineralized volcanic rocks are cut off by a mass of feldspar porphyry and diorite to the East. To the West a feldspar porphyry body limits the mineralization.

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One can say that the volcanic body has a rough shape of a pyramide whose base would be down in depth. Therefore, the chances of finding mineralization increases towards the depth.

5. Conclusion and Discussion

The origin of the mineralization is still not completely clear. Is it syngenetic, intraplutonic, purely hydrothermal?

We can make the following hypotheses:

a) The copper was contemporaneous with the volcanic rocks and was partially remobilized because of effects of the tectonics.

b) The copper was disseminated in the plutonic rocks (granodiorite and/or porphyry) and moved into the volcanic rocks

c) The copper came through the granodiorite and filled any fractures in both intrusive and extrusive rocks.

The last hypothesis (c) seems to be the best as the mineralization seems to be most abundant in the zone of numerous microfractures and shears. It is also related with the silica and chlorite alterations.

J.P. Nicolet, Geol.

To conclude, one can assume subjectively that one might be dealing with a hydrothermal and/or porphyry copper type of mineralization.

J.P. Nicolet, Geol.

TABLE I

Assays Value Cu%

	Footage			Sludge	Channel Sampling				
	From	to	length		Left Wall	Right Wall	Average	Muck	Rock Type
Adit	40	510	470'	0.09	--	--	--	--	Porphyry
	126	200	74'	0.22	0.18	0.24	0.21	--	"
	170	188	18'	0.51	0.68	0.39	0.54	--	"
	501	516	15'	0.19	1.09	0.03	0.60	--	Volcanic and Porphyr
	516	543	27'	1.02	0.46	0.74	0.60	0.82	Volcanic
	543	561	18'	0.56	1.52	0.57	1.04	--	"
Cross-cut G1 follow-up of mineral-ization	0	281	281'	0.65	--	--	--	--	Volcanic
	44	77	33'	--	1.52	0.28	0.91	--	"
	42	79	37'	1.58	--	--	--	--	"
	36	57	21'	1.32	--	--	--	1.41	"
	62	83	21'	0.99	--	--	--	1.83	"
	90	96	6'	1.52	--	--	--	1.88	"
	99	126	27'	0.77	--	--	--	0.93	"
	113	121	6'	1.08	--	1.24	--	0.90	"
	124	130	6'	0.82	0.61	--	--	--	"
	132	138	6'	0.74	--	--	--	0.74	"
	140	146	6'	0.65	--	0.24	--	--	"
	151	157	6'	0.56	1.00	--	--	--	"
	79	158	79'	0.95	--	--	--	--	"
	160	180	20'	0.47	--	--	--	0.60	"
	197	210	13'	0.15	--	--	--	0.26	"
	158	200	42'	0.43	--	--	--	--	"
	200	281	81'	0.19	--	--	--	--	"
Cross-cut G2	2	22	20'	0.61	--	--	--	--	"
	22	62	40'	0.29	--	--	--	--	"
	62	148	86'	0.04	--	--	--	--	"

TABLE II

Assay Values % Cu Ag OZ/t

	Footage			Sludge		Rock Type
	From	to	length	% Cu	Ag OZ/t	
Adit	170	188	18	0.51	No assay	Porphyry
	510	558	48	0.85	0.23	"
Cross-cut G1-follow-up mineralization	0	281	281	0.65	No assay	Volcanic
	26	197	111	0.95	0.58	"
Cross-cut G 2	0	24	24	0.6½	0.20	"

APPENDIX I

Personnel Certificates

NICOLET, Jean-Paul: Geologist. Graduate of University of Lausanne, Switzerland. Engaged in mineral exploration in Canada since 1966, while in employ for Falconbridge Nickel Mines Ltd., Amax Exploration Inc., Mokta and Pechiney 1969 - present.

HUSSON, Bernard L.: Geologist from ENSG (Ecole Nationnale Superieure de Geologie, Nancy, France). Age 22, Box 728, Terrace, B.C. Engaged in mineral exploration in Canada since Summer 1968; works for Mokta.

CARON, Michael E.: First year science UBC (preengineering), 3336 W. 2nd Avenue, Vancouver 8; age 21, Summer 1969 Mokta (Canada) Ltèe. Geochemical soil sampling under supervision and assistant of one geologist.

DUFF, Robert: First year science UBC, 1447 Barclay St. Vancouver. Worked five days with Mokta in June 1969.

PIRIOU, Stephan: Box 728, Terrace, B.C. 6 weeks prospector courses at the University of Montreal. Age 23, Summer 1969 with Mokta (Canada) Ltèe. Geochemical soil sampling under supervision; assistant of one geologist.

HUMBERT, André: Geologist from ENSG (Ecole Nationnale Superieure de Geologie, Nancy, France) Age 22. Summer 1969 with Mokta (Canada) Ltèe mapping in Saskatchewan and B.C.

D'ARTOIS, Michael: Box 728, Terrace B.C. First year student in Art; first year Carlton University; age 22. Worked in November and December 1969 with Mokta. Crushed the samples and look after all shipping.

LANDRY, Jean-Guy: Barraute, Abitibi, Quebec. Labor 26 days in August 1969 and beginning of September 1969. Mokta (Canada) Ltèe.

GAGNON, Placide: Labor, Barraute, Abitibi, Quebec. 26 days in August 1969 and beginning of September 1969. Mokta (Canada) Ltèe.

BOULLIANE, Cyril: labor, Barraute, Abitibi, Quebec. Worked 4 days in August 1969. Mokta (Canada) Ltèe.

APPENDIX II

Personnel and Dates Worked

Name	Type of work	Dates worked
J-P. Nicolet	Geology (mapping) 93 man days, Supervision 20 man days	June 1st to September 30
B. Husson	Geology (mapping) 97 man days, Data reduction (15 days), Mapping in addit44 man days	June 1st to September 30 November 4 to December 17
M. Caron	Geological assistant 60 man days, Geochem. soil sampling 20 man days, Camp construction 9 man days	June 1st to September 1st
R. Duff	Geological assistant 2 man days, Geochem 2 man days	June 1st to June 5th
S. Piriou	Geological assistant 54 man days, Geochem. soil sampling 28 man days, Camp construction 9 man days, Data reduction 8 man days	June 15 to September 30
A. Humbert	Mapping and sampling in adit 44 man days	November 4 to December 17
M. D'Artois	Sampling under supervision 44 man days	November 4 to December 17
J-G. Landry	Trenching 26 man days	Aug. 10 to Sept. 4
P. Gagnon	Trenching 26 man days	Aug. 10 to Sept. 4
C. Boulliane	Trenching 4 man days	Aug. 10 to 14

APPENDIX III
Cost breakdown

1. a) Geological mapping
   J-P. Nicolet (93 days at $ 40.00 per day) = 3720.00
   B. Husson (97 days at $ 30 per day) = 2910.00
   M. Caron (60 man days), R. Duff (2 man days),
   S. Piriou (54 man days); all at $ 30.00 per day:
   116 x 20 = 2320.00
   b) Helicopter support in the field; 30 hours and 5
   minutes at $ 235.00 per hour = 7065.00

2. Geochemical soil sampling
   Caron 20 man days
   Piriou 28 man days
   Duff 2 man days
   All at 20 dollars a day; total 50 man days at
   $ 20.00 = 1000.00

3. Geochemical analysis
   75 silt and 283 soils
   Total 358 samples at $ 1.20 per sample = 429.60

4. Trenching
   Boullane 4 man days
   Gagnon 26 man days
   Landry 26 man days
   All at 25.00 dollars per day; total 56 man days
   at $ 25.00 = 1400.00

5. Assays for Cu, Au and Ag of the trenches at
   $ 14.50 per sample.
   Total 40 samples at 14.50 dollars = 667.00

6. 25 thin sections study at $ 17.00 a section = 425.00

7. Camp construction, 18 man days
   Caron 9 man days
   Piriou 9 man days
   All at $ 20.00 per day, total 18 man days at $ 20.00 = 360.00

8. Supervision
   J-P. Nicolet, 20 man days at $ 40.00 per day
   Total 20 man days per $ 40.00 = 800.00

9. In field cost supply 473 man days at $ 7.00 a day
   Total 473 man days per $ 7.00 = 3311.00

10. Data reduction
    Piriou 8 man days at $ 20.00 per day
    Husson 15 man days at $ 30.00 per day
    Total = 610.00

11. Rental of vehicle, Toyota 4 x 4 and Chevrolet
    4 x 4 at $ 14.00 during 120 days = 1680.00

12. Subsurface work

a)	Cost of driving adit and cross-cut on Zymoetz N. 2 and Kelly N. 3 claims	= 102,320.00
b)	Geological mapping and channel sampling B. Husson 44 man days at $ 30.00 per day A. Humbert 44 man days at $ 30.00 per day Total 88 man days at $ 30.00 per day	= 2 640.00
c)	Preparation of samples (drying and crushing) M. D'Artois 44 man days at $ 20.00 per day	= 880.00
d)	Assays, 366 samples analyzed for copper at $ 5.50 a sample	= 2 013.00
e)	In field cost supplay 132 man days at $ 7.00 a day	= 924.00
d)	Rental of vehicle Ford 4 x 4 at $ 14.00 a day	= 616.00
		136090.00

APPENDIX IV

Cost appropriation
of Native, Kom, Pany groups
of claims

KOM GROUP (40 claims)

1.	Geological mapping on claims Atkom no. 1 to no. 16 incl., Kelly no. 30, Saint no. 5 to 9 incl., Saint no. 11 to 16 incl., Saint no. 35 to 44 incl.	= 5,338.33
2.	Geochemical soil sampling 63 samples on Saint no. 6 and Kelly no. 30, 180 samples on Atkom no. 1 and 11 50 man days at $ 20.00	= 1,000.00
3.	Geochem. analysis	= 429.60
4.	Trenching 10 man days on Atkom 11 (Mountain Goat showing) 6 man days on Atkom 5 (Zone faillèe) 10 man days on Atkom 8 (Mike Showing) 14 man days on Saint 6 Total 40 man days at $ 25.00	= 1,000.00
5.	Assays 34 at $ 14.50	= 493.00
6.	Thin sections 9 at $ 17.00	= 153.00
7.	Camp construction 6 man days at $ 20.00	= 120.00
8.	Supervision 6 man days at $ 40.00	= 240.00
9.	In field cost supply 152 man days at $ 7.00	= 1,064.00
10.	Data reduction: 4 man days at $ 20.00 5 man days at $ 30.00	= 230.00
11.	Rental of vehicle 40 days	= 560.00
		10,627.93

$ 10,627.93 to apply for the group for 2 1/2 years assessment

NATAN GROUP

1.	Geological mapping on claims Kelly no. 1 to 4 incl., Kelly no. 6 to 10 incl., Kelly no. 12 to 18 incl., Saint no. 1 to 4 incl., Native no. 1 to 8 incl., Tan no. 9 to 11 incl., Tan no. 13, Tan no. 15 and 16	=	5, 338.33
4.	Trenching: on claim Kelly no. 4 (East side showing) to apply for Natan Group. 2 man days	=	50.00
5.	Assays for trenching 10 samples at $ 14.50	=	145.00
6.	Thin sections 8 at $ 17.00	=	136.00
7.	Camp construction 6 man days at $ 20.00	=	120.00
8.	Supervision 8 man days at $ 40.00	=	320.00
9.	In field cost supply 157 man days at $ 7.00	=	1, 099.00
10.	Data reduction 5 man days at $ 30.00 2 man days at $ 20.00	=	190.00
11.	Rental of vehicle	=	560.00
12.	Subsurface work		
	Cost of cross-cut on Kelly 3 to apply for the Natan Group	=	51, 160.00
	Geological mapping and channel sampling	=	1, 320.00
	Preparation of samples	=	440.00
	Assays	=	1, 006.50
	In field cost supply	=	462.00
	Rental of vehicle	=	308.00
			62, 654.83

$ 62,654. 83 to apply for the group for 15 years assessment

PANY GROUP (40 claims)

1.	Geological mapping on claim Pan no.2, no. 4, no. 6, Zymoetz no. 1, no.2, no. 6, no. 8, no. 14, no. 15, no. 6 fraction, no. 1 fraction, no. 2 fraction, Kelly no. 5, Kelly no. 24 - 32 incl., Zymoetz no. 10 to 13 incl., Aktom no. 19 to 23 incl., to apply for the group:	= 5, 338.33
4.	Trenching: on Atkom 20 (Calona showing) to apply for the group 14 man days at $ 25.00	= 350.00
5.	Assays 2 at $ 14.50	= 29.00
6.	Thin sections 8 at $ 17.00	= 136.00
7.	Camp construction 6 man days at $ 20.00	= 120.00
8.	Supervision 6 man days at $ 40.00	= 240.00
9.	Field cost 164 days at $ 7.00	= 1,148.00
10.	Data reduction 2 man days at $ 20.00 5 man days at $ 30.00	= 190.00
11.	Rental of vehicle	= 560.00
12.	Subsufface work on claim Zymoetz no. 2 to apply for the Pany Group	
	Cost of adit and cross-cut	= 51,160.00
	Geological mapping and channel sampling	= 1,320.00
	Preparation of samples	= 440.00
	Assays	= 1,006.50
	In field cost supply	= 462.00
	Rental of vehicle	= 308.00
		62,807.83

$ 62,807. 83 to apply for the group for 15 years assessment

APPENDIX V

Thin section study

SPECIMEN ZA-1 : Andésite gris-vert. Unité 1

Hand specimen : Pale green aphanitic rock with mottled appearance due to about 3% rounded fine-grained patches of dark green material. One surface is a joint filled with pale green epidote. Specimen is an altered volcanic.

Thin section : Mineralogy is as follows :

Plagioclase (65%) occurs mostly as slightly stubby prisms with apparent random orientation. Anhedral. A very small percentage occur as phenocrysts up to 2 mm. long and extensively replaced by chlorite.

Epidote (30%) var. pistacite. Almost entirely interstitial as anhedral grains up to 0.2 mm diameter. Also in thin veinlets (seen only in hand specimen).

Chlorite (5%) common in patches of fibrous mattes that commonly have a core of epidote. These are probably amygdules. Also as microcrystalline replacement of plagioclase, especially phenocrysts. Occurs also as fine-grained interstitial blebs.

Opaque Minerals (trace) a few small grains that were not identified.

Quartz (trace) in part, chalcedony. Occurs in patches up to 1 mm in diameter with epidote. Probably amygdular.

The specimen is an aphanitic igneous rock of volcanic origin, slightly porphyritic, with rare, small amygdules. It is extensively altered, mainly to epidote. No primary mafic minerals remain but are now represented by chlorite and epidote. Amygdules are filled with epidote, chlorite ans rarely quartz.

The rock is an epidotized andesite.

SPECIMEN ZA-2 : Andésite rouge. Unité 1

Hand specimen : Fine-grained, massive, amygdaloidal rock. Numerous thin laths of white feldspar in aphanitic, purplish-coloured groundmass. Amygdules ($\frac{1}{4}$") of coarse white calcite, epidote and quartz. Several short veinlets of quartz and epidote. Scattered smaller amygdules of soft, very dark, aphanitic material.

Thin section : Fabric composed essentially of randomly oriented, elongate laths of anhedral plagioclase (50%), set in finer-grained groundmass of needle-like plagioclase, small equant grains of feldspar (?), fine opaque material, and abundant red-brown hematite "dust" which gives section a very turbid appearance. Larger plagioclase euhedral are twinned but unzoned, composition albite or sodic oligoclase. Rock also contains scattered euhedral grains of unknown mineral (5%), now pseudomorphed by nearly isotropic chlorite.

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Amygdules of two types : larger ones composed of coarse mosaic epidote, quartz and lesser calcite ; smaller amygdules mostly very fine-grained chlorite, with concentric zones or cores of coarser mosaic epidote.

Thin veinlets of quartz and some calcite and epidote. Some of the quartz is conspicuously euhedral ; some quartz very fine-grained with radiating habit (chalcedony).

Alteration rather extensive : small bits of carbonate and white mica scattered through plagioclase ; pseudomorphs of unknown mineral ; strongly turbid groundmass which may have been glass in part.

Specimen is an altered amygdaloidal volcanic rock, composed largely of plagioclase - andesite or possibly latite.

SPECIMEN ZA-6 : Diorite Sud Calona showing

Hand specimen : Very homogeneous, massive, grey-green, medium/fine-grained dioritic rock. Colom Index approx. 40. Looks altered, but excellent subophitic (diabasic) texture. Trace scattered specks of metallic minerals. Some epidote segregated along fracture.

Thin section : Rock is composed of randomly oriented, subhedral, elongate grains of plagioclase (approx. 60%) with interstitial mafic minerals. Extensive alteration, but igneous fabric still very conspicuous. Plagioclase is twinned but unzoned, turbid, and contains numerous inclusions of anhedral epidote, small bits of amphibole, and small flakes of white mica (?). Composition of plagioclase near albite (R.I. less than balsam).

Mafic minerals mostly light green amphibole (23%) as larger grains interstitial to plagioclase, and scattered flakes. Pale yellow-green epidote (10%) as scattered grains. Opaques (5%) and associated turbid sphene (10%) evenly distributed through rock. Some chlorite (2%) associated in clots with amphibole ans epidote. Some opaques tend to show square cross-section ; many rimmed with turbid "sphene". No primary mafics, but locally get darker and slightly brownish-green amphibole in centre of mafic areas.

Specimen is a diapthoritic igneous rock of dioritic composition. Most likely a diabase dyke ; less probably from a small stock or an andesite flow.

SPECIMEN ZA-7 : Porphyre andésitique Mountain Goat showing

Hand specimen : Porphyritic volcanic rock, probably an andesite with about 25% slender white plagioclase laths with trachytic structure set in a purple aphanitic matrix. Phenocrysts are mostly 2-3 mm long. A few small amygdules with chlorite or calcite filling are present.

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Thin section : Mineralogy is as follows :

Plagioclase (75%) about half of the plagioclase occurs as phenocrysts up to 4 mm long. These have a composition of albite. The remainder occurs as microlites in the matrix.

Opaque minerals (8%) most is a fine opaque dust occuring in the matrix. Some forms thin rims about chlorite patches. There are a few large euhedral crystals of magnetite about 1 mm in diameter. Much of the "dust" is hematite.

Prehnite (5%) in amygdules where it forms radiating clusters. Also as small alteration patches throughout the matrix.

Chlorite (5%) some as pseudomorphs after pyroxene crystals and much as amygdule filling associated with epidote especially. Pseudomorphic patches have rims of opaque matter.

Epidote (3%) var. pistacite. Alteration of plagioclase. Also associated with prehnite and chlorite in amygdules.

Calcite (3%) as anhedral masses filling amygdules with some quartz.

Quartz (trace) minor amounts in calcite amygdules.

The rock is a porphyritic amygdaloidal andesite that has been altered to a moderate degree. It is not clear whether plagioclase was originally as sodic as at present. Alteration has probably accompanied filling of amygdules where the paragenetic sequence is (1) epidote and prehnite, (2) chlorite, and (3) calcite and quartz.

Main alteration effects (perhaps deuteric) have been albitization of plagioclase and chloritization of mafic minerals, with some magnetite being a byproduct of the latter process.

SPECIMEN ZA-8 : Latite ou microsyénite Mountain Goat showing

Hand specimen : Rock is a volcanic porphyry with about 50% grey, aphanitic matrix and 50% grey-white, lath-shaped phenocrysts up to 3 mm long. Specimen contains a pink "granitic" inclusion about 1.5 cm in diameter.

Thin section : Mineralogy is as follows :

Feldspar (45%) phenocrysts, some are plagioclase, others appear to be K-feldspar. Proportion of each difficult to determine because little original material remains, being largely replaced by calcite and sericite.

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Matrix (45%) cryptocrystalline mosaic of felsic minerals largely replaced by sericite and calcite.

Quartz (5%) phenocrysts, euhedral to subhedral in form. Partly resorbed. Diameters range from 3 mm to a fraction of a mm.

Mafic minerals (5%) original nature uncertain. Now completely replaced by chlorite with some sericite and rare opaque matter, calcite and quartz.

The specimen contains a pink inclusion of medium-grained plutonic rock that has a granitic composition, consisting mainly of K-feldspar with quartz and minor plagioclase, calcite, sericite, chlorite, apatite and small opaque grains. Specimen is about 50-50 phenocrysts and matrix. The most obvious phenocrysts at present are quartz. Plagioclase phenocrysts and the aphanitic matrix are almost completely replaced in places by abundant calcite and sericite. Mafic minerals have been replaced completely by chlorite with appreciable sericite and minor amounts of calcite, quartz and needle-like inclusions of an unidentified mineral.

The rock is an extensively altered porphyritic latite. Alteration effects are mainly sericitization and carbonatization with less abundant chloritization.

SPECIMEN ZA-10 : Rhyolite (dykes du centre de la propriété)

Hand specimen : Very fine-grained, pale buff, massive rock with rough, irregular fractures, some of which have a black stain locally with dentritic pattern (perhaps Mn oxides). Texture appears granular.

Thin section :

Feldspar (60%) altered, with percasive "dusty" appearance (possibly products of argillic alteration). No twins observed.

Quartz (28%) minute grains about 0.04 mm diameter. A few are twice that length. All are anhedral.

Sericite (8%) patches up to 0.2 mm diameter. Mostly as smaller laths more or less evenly distributed throughout section.

Opaque minerals (4%) very fine-grained, "dusty" matter dispersed through section.

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The most characteristic feature of the rock is the presence of about 3% feldspar as small spherulites about 0.3 mm diameter. Unfortunately these can be seen only in thin section and not megascopically. However, they prove the igneous origin of the specimen.

Alteration is not intensive but is fairly pervasive. All feldspars appear "dusty" in thin section, probably due to argillic alteration. Sericite does not appear to be an alteration product, rather it is a late crystallate.

The rock is probably a rhyolite in composition.

SPECIMEN ZA-11 : Agglomérat Unité 1

Hand specimen : Specimen is a breccia, perhaps tectonic although this is difficult to say. Fragments are angular and up to 1 inch in maximum dimension. Interstices are filled with epidote and quartz. Most fragments are purplish in colour and appear to be aphanitic volcanics. A few contain white phenocryts.

Thin section :

Fragments account for 85% of the specimen. They vary drasticcaly in size from very small up to 1 inch in length. Most are angular. They are mainly volcanic, some being purely aphanitic, others porphyritic. Most are andesitic in composition. Some of the small fragments are broken crystals of plagioclase. All opaque minerals within the section are distributed through the fragments.

Interstitial material accounts for 15% of the specimen. Minerals present in decreasing order of abundance are epidote (var. pistacite), calcite and quartz, with trace amounts of chlorite. All are anhedral and very erratically distributed in the specimen.

The rock is a volcanic breccia with interstitial epidote, calcite, quartz and chlorite. Virtually no alteration of fragments has occured.

SPECIMEN ZA-12 : Porphyre andésitique - Upper showing

Hand specimen : AX drill core. Grey, with about 10% large pink phenocrysts of feldspar, up to 4 mm long. Also contains a few small amygdules of chlorite. Cut by thin calcite vein.

Thin section : Mineralogy is as follows :

Plagioclase (75%) occurs in part as phenocrysts that are stubby prisms up to 4 mm long. Most occurs as a mesh of microlites with albite twinning. Present composition is albitic but plag has patchy appearance due to more calcic relicts.

Chlorite (10%) fine grained, almost isotropic interstitial masses. Also a few recognizable amygdules.

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Opaque Minerals (9%) some is magnetite, occuring evenly distributed through section in large and small anhedral masses. Some is hematite. Proportions of the two uncertain.

Calcite (5%) Interstitially and in amygdules. Also as minute anhedral grains within plagioclase.

Epidote (1%) var. pistacite. In amygdules and replacing plagioclase, as small anhedral masses. Generally early in paragenetic sequence in amygdules.

Quartz (trace) anhedral grains associated with calcite in a few places.

The rock is an altered porphyritic andesite in which plagioclase has been largely albitized with destruction of the primary textures, and interstertal material has been replaced by epidote, chlorite, quartz and calcite in that order of deposition. Opaque minerals are in part magnetite and in part hematite. Hematite appears to be an alteration product and is related in time to epidote, chlorite etc...

SPECIMEN ZA-13 : Porphyre andésitique - Upper showing

Hand specimen : Fine-grained porphyritic rock. Groundmass purplish-grey, aphanitic. Phenocrysts of elongate, euhedral plagioclase to 3/8" long, altered greenish appearance. Scattered small grains of altered reddish mineral. Numerous scattered "spots" of very dark aphanitic material, many angular in form.

Thin section : Groundmass (35% of total) consists of fine-grained mixture of albitic plagioclase, epidote, chlorite, carbonate, opaques and unidentified turbid material (some of which is probably turbid sphene).

Plagioclase phenocrysts (25%) are euhedral, randomly oriented, and contai numerous small inclusions of carbonate, chlorite, epidote and small irregular patches of potash feldspar. Composition albite or sodic oligoclase, unzoned.

Scattered subhedral grains of altered mineral (10%), heavily charged with red hematite "dust" on margins and cleavage. Cores are virtually isotropic, faintly pleochroic from pink to greenish ; possibly pseudomorphs of orthopyroxene.

Chlorite (30%) as very fine-grained aggregates, almost isotropic. Mostly in angular patches intersertial to plagioclase laths ; this probably represents infilling of the voids in a primary "diktytaxitic" texture. Chlorite also in a few small round amygdules ; some of these have concentric zones of fine-grained chalcedony and/or epidote.

Original rock probably a porphyritic, orthopyroxene (?), plagioclase andesite with "diktytaxitic" texture. Extensively altered : no primary mafics, plagioclase now albite, and chlorite fills voids. Retrograde assemblage : albite, epidote, carbonate, chlorite, opaques.

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SPECIMEN ZA-15 : Porphyre rhyolitique - Upper showing

Hand specimen : Very dark grey, massive, aphanitic rock. Several percent of euhedral feldspar phenocrysts approx. 2 mm in size. Trace small grains of red mineral in specimen in dark clot, not seen in thin section. Scattered spots of opaques, approx. 1 mm diameter. Very thin veinlets common, various directions. Thin veinlet of calcite on one end of core. Specimen weakly magnetic.

Thin section : Pehnocrysts (10%) of alkali feldspar (2V neg, approx. 40°), probably orthoclase/sanidine. Sharply euhedral, with a few inclusions of epidote, quartz, and white mica. Also 1% or less of quartz phenocrysts, anhedral in form.

Groundmass consists of a very fine-grained, intimately mixed mosaic of quartz (25%), feldspar (35%), chlorite (20%), white mica (10%), opaques and turbid brown material (8%), epidote (2%), and trace carbonate (proportions difficult to estimate, and thus very approximate). Groundmass possibly devitrified glass in whole or in part, but textural evidence is inconclusive. Scattered subhedral crystals of apatite (< 1%), most associated with opaques.

Opaque "spots" (magnetite) are rounded mosaic aggregates of fine-grained opaque mineral mixed with lesser chlorite, white mica, and feldspar. Spots make up about 3% of total rock.

Thin quartz vein with minor opaques along margins. This vein cut by very thin veinlets of carbonate and white mica. Mica veinlets are lined with abundant fine-grained opaques ; calcite veinlets are free of associated opaques.

Specimen is partly altered, porphyritic "rhyolite". Some opaques appear to be introduced along with white mica ; "spots" of opaque appear to be primary, but may be "rearranged" somewhat.

SPECIMEN ZA-16 : Granodiorite - Lower showing

Hand specimen : Medium-grained, homogeneous, massive, slightly mottled-looking granitoid rock. Colour index approx. 30. Mafic minerals greenish, appear altered. Vein of calcite across core, 4 mm thick, looks slightly sheared. Specimen is distinctly magnetic.

Thin section : Plagioclase (45%) as subhedral laths. Altered, with numerous inclusions of white mica and chlorite, especially in center parts. Composition albitic, but strongly altered zones indicate originally calcic cores.

K-feldspar (15%?) as overgrowths on plagioclase, and separate grains intersertial to plagioclase. Cloudy brownish appearance, some grains perthitic.

Quartz (10%) as anhedral grains ; occurs along with K-feldspar in intersertial relationship to plagioclase.

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Mafic minerals (30% total) tend to be associated with each other. Clinopyroxene (8%), amphibole (2%), opaques (10%), chlorite (10%). Some grains of clinopyroxene are subhedral and twinned ; slightly to strongly altered. Amphibole is light greenish-brown, locally intergrown with pyroxene. Opaques (magnetite) are anhedral, evenly distributed. Chlorite occurs as "subhedral" grains (pseudomorphs of unknown mafic mineral ?), and as small bits in plagioclase. Apatite (1%) is a common accessory, associated with mafics, as small subhedral crystals.

Alteration ranges from slight to extensive : cores of plagioclase with abundant white mica and chlorite. Clinopyroxene partly altered to chlorite and carbonate. Some mafic minerals fully chloritized. Also 1% (or less) of unknown flaky alteration mineral (relief and birefringence like that of amphibole, but cleavage traces are parallel to fast optic ray - possibly prehnite).

Several thin veinlets of carbonate, not abundant.

Rock shows minor evidence of strain : carbonate veinlets appear slightly sheared, and some quartz grains have strain lamellae.

Specimen is a partly altered, plutonic rock of approximately granodiorite composition. (Rock is slightly unusual in that quartz content is low for granodiorite).

SPECIMEN ZA-17 : Granodiorite - Lower showing

Hand specimen : Massive and homogeneous, medium/fine-grained, equigranular, igneous-looking rock. Colour medium grey, colour index approx. 25. Feldspar shows good cleavage and twinning strae. Mafic minerals green and chloritic-looking. Rock is distinctly magnetic.

Thin section : Plagioclase (55%) as subhedral, well-twinned grains, with numerous included bits of white mica and carbonate. Composition albitic (relief less than balsam) ; euhedral cores originally calcic as suggested by more abundant alteration minerals.

K-feldspar (7%?) as anhedral mosaic grains intersertial to plagioclase, and a few small irregular patches in plagioclase. Brownish turbid appearance, otherwise difficult to distinguish from albitic plagioclase.

Quartz (13%) as small anhedral mosaic grains, tend to be near chlorite.

Opaques (10%) presumably magnetite ; as evenly distributed anhedral grains.

Apatite (2%) as elongate, slightly rounded euhedral crystals.

Chlorite (12%) in angular forms intersertial to plagioclase laths, associated with carbonate and epidote - apparently representing pseudomorphs of unknown mafic mineral. Also scattered anhedral flakes.

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Epidote (1%) as scattered anhedra , some associated with chlorite. Relatively strongly coloured (fe-rich).

Sphene (< 1%) small anhedral associated with opaques ; also fuzzy bits as inclusions in chlorite.

Fabric dominated by larger, subhedral plagioclase laths, with intersertial mosaic of finer quartz, chlorite, and K-feldspar (?).

Alteration extensive ; plagioclase is albite with abundant included white mica and carbonate ; mafic altered to chlorite + carbonate-epidote-sphene.

Several thin veinlets of carbonate and minor quartz - not abundant.

Specimen is an altered, fine-grained, granitoid igneous rock with a composition approximating granodiorite (the rock is slightly unusual in that quartz content is low for granodiorite, and magnetite is relatively abundant).

SPECIMEN ZA-18 : Granodiorite - Lower showing

Hand specimen : Medium-grained rock of plutonic origin. About 60% grey grains and 40% pink grains. Cut by thin chalcopyrite-bearing calcite veinlet.

Thin section :

Plagioclase (40%) subhedral laths about 3 mm long. Replaced by calcite and locally, chlorite.

Quartz (20%) most occurs as anhedral interstitial grains with mosaic texture. Some occurs in veinlets.

K-feldspar (20%) var. Orthoclase. Large anhedral crystals late in paragenetic sequence.

Chlorite (8%) replaces plagioclase in part. Mainly in large irregular patches with epidote.

Myrmekite (7%) vermicular intergrowth of quartz and K-feldspar. (micrographic intergrowth). Probably a primary crystallate.

Opaque minerals (3%) mainly anhedral magnetite associated with chlorite. A small amount of chalcopyrite occurs in a calcite vein.

Calcite (2%) as blebs replacing plagioclase, as interstitial grains, and in late veinlets.

Apatite (trace) a few anhedral grains associated with opaque minerals.

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The rock is cut by a quartz vein which contains centrally located anhedral masses of calcite. In places the vein is cut by small calcite veinlets.

The texture is granular, medium-grained, with anhedral grains ranging from 0.5 to 3.0 mm diameter. Most of the larger grains are K-spar. Vermicular intergrowths of K-spar and quartz (micrographic texture) are common in interstitial positions and probably represents a late eutectoid crystallate.

In places K-spar is extensively replaced by sericite and calcite. Of the two calcite is most abundant.

The specimen is a medium-grained plutonic rock of quartz monzonitic composition, that is pervasively altered with retention of the original texture. The most characteristic primary feature is interstitial granophyre (vermicular intergrowths of quartz and K-feldspar). Feldspars are somewhat carbonatized, and locally, are sericitized. Mafic minerals have been replaced entirely by chlorite.

SPECIMEN ZA-19 : Diorite - Upper showing

Hand specimen : Massive, homogeneous, medium/fine-grained. Colour very dark greenish-grey. Thin platy feldspar and trace quartz visible in specimen. Distinctly magnetic. Several thin veins filled with white and pale green minerals. Pyrite disseminated along one face of specimen -- not seen in section.

Thin section : Plagioclase (60%) markedly elongate euhedral grains, with abundant included very fine-grained white mica, minor epidote and chlorite. Composition somewhat obscured by alteration, but is albite or sodic oligoclase.

Clinopyroxene (20%) pale brownish colour. A few grains subhedral, most intersertial to and enveloping plagioclase prisms. (subophitic texture). Local brown cloudy alteration on margins.

Chlorite (13%) as very fine-grained aggregates occupying angular interstices in plagioclase framework. Associated fine-grained opaques, and bits of fuzzy, brown, translucent material (altered sphene/ leucoxene ?).

Opaques (5%) magnetite, ranges from subhedral to irregular in form ; small anhedral probably by-product of alteration.

Apatite (< 1%) as small slender prisms included in other minerals.

Quartz (3%) small anhedral grains, intergranular.

Fabric dominated by network of randomly-oriented, elongate plagioclase, with other minerals largely intersertial. Excellent igneous texture.

Several thin veins composed of prehnite (?) + carbonate + epidote. Vein minerals form a mosaic with complexly interfeathered grain boundaries. Margins of veins grade into host rock through diffuse zone of cloudy alteration. Also several very thin veinlets of quartz.

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Specimen is a partly altered, quartz-bearing "diorite". Origin of intersertial chlorite masses uncertain. Rock is quite dark in hand specimen -- looks gabbroic.

SPECIMEN ZA-20 :"Granodiorite rose " - Chicken showing

Hand specimen : The rock is a medium-grained diorite consisting of altered plagioclase, about 10% pink potash feldspar, and 20% interstitial mafics. The rock is strongly magnetic. Chalcopyrite and minor malachite appear to be largely controlled by fractures, although there is minor disseminated chalcopyrite. The copper content is estimated at 0.5%.

Thin section : The slide is primarily composed of granitic-textured plagioclase, K-feldspar and chlorite ; there is no foliation.

Plagioclase (65%) occurs as subhedral grains about 4 mm in diameter. The plagioclase (andesine) is everywhere clouded with alteration products, chiefly sericite and epidote, and has been largely replaced by chlorite.

K-feldspar (15%) occurs as anhedral grains interstitial to the plagioclase. It is clouded with submicroscopic grains of alteration minerals, possibly hematite, The pink color as seen in hand specimen is probably due to this hematite dust, and not to the presence of hydrothermal K-feldspar.

Apatite (1%) is present as small euhedral grains.

Chlorite (pennine) is the only mafic mineral present.
It forms about 15% of the rock, and generally occurs as interstitial aggregates up to 5 mm across. It has formed primarily by the alteration of the original mafics probably hornblende.

Opaques (4%) both magnetite and chalcopyrite are closely associated with chlorite ; very little of either is present in the feldspars.

The rock is an altered chloritic diorite of intrusive origin. Alteration, probably deuteric has been moderately strong. The rock was subjected to stress during and after crystallization, as is shown by bent twin lamellae in the plagioclase. The resulting fractures have served as the site of deposition for much of the chalcopryite.

SPECIMEN ZA-21 : Andésite - Chicken showing

Hand specimen : The rock is a dark grey-green andesite composed of phenocrysts of altered plagioclase (40%) set in a dark green aphanitic matrix. Tiny disseminated grains of chalcopyrite and minor hematite are present ; the grade is visually estimated at 0.08% Cu. The rock is moderately magnetic.

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Thin section : The slide consists of plagioclase phenocrysts set in a felted matrix of fine-grained plagioclase and chlorite. No orientation of the phenocrysts or foliation within the matrix was observed, and there are no original mafic minerals.

Euhedral plagioclase phenocrysts up to 5 mm in diameter form 35% of the rock. The phenocrysts (andesine) are altered to carbonate, chlorite, and minor epidote and sericite. The degree of alteration varies from strong to very strong ; commonly the cores have been totally replaced while the rims have been only moderately affected. Plagioclase in the matrix is less altered than the phenocrysts ; sericite and epidote are the main alteration products.

Chlorite (pennine) forms about 20% of the matrix. Much of the chlorite appears to have resulted from the alteration of the original mafic minerals.

Epidote occurs both as an alteration product of plagioclase and, more commonly, as partial fillings of small (1 mm) vessicles.

Opaques. Magnetite (4%) occurs as euhedral to anhedral grains about .05 mm in diameter disseminated evenly through-out the matrix. Chalcopyrite is irregularly disseminated as grains up to 1 mm in diameter that are closely associated with chlorite.

The rock is an altered andesitic flow. Alteration has been strong and is probably hydrothermal in nature.

SPECIMEN ZA-24 ; Agglomérat rouge - Unité 3

Hand specimen : This is a dark reddish-green rock composed of 1 mm plagioclase laths (10%), reddish rock fragments (5%), and chlorite (10%) set in an aphanitic matrix. A pink zeolite is common along fractures. Faint traces of bedding are visible. The rock is an unmineralized fine-grained volcanic breccia.

Thin section : The rock is a pyroclastic consisting of plagioclase crystals and rock fragments set in a dense chloritic matrix.

Plagioclase crystals (andesine) comprise 15% of the rock. The grains range in size from .1 to 2 mm, and are commonly euhedral, but may be broken. The plagioclase is somewhat cloudy due to partial alteration to clinozoesite and sericite.

Rock fragments comprise 5% of the rock volume. These are generally subangular, and vary from .5 to 3 mm in diameter. The fragments are volcanic in origin, and generally consist of tiny phenocrysts of plagioclase set in a cryptocrystalline matrix. Very fine-grained opaques in the matrices are probably hematite and account for the reddish colour of the fragments in hand specimen.

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The matrix consists of yellow-brown chlorophaeite (40%), chlorite (40%), and lesser amounts of epidote, feldspar, augite, and opaques. The chlorite appears to have formed at the expense of chlorophaeite and plagioclase. The small grains of augite are invariably partially replaced by epidote. Opaques (magnetite and hematite) form about 3% of the matrix.

The rock is a fine-grained volcanic breccia. Alteration (mainly chlorite) has been strong, and is probably deuteric, although it is possibly low-temperature hydrothermal.

SPECIMEN ZA-25 : Agglomérat rouge - Unité 3

Hand specimen : The rock consists of fine-grained, red rock fragments (15%) and plagioclase crystals (7%) set in a dark red-green aphanitic matrix. The rock contains about 1% zeolite amygdules up to 2 mm in diameter. The rock is an unaltered and unmineralized fine-grained volcanic breccia.

Thin section : The rock consists of grains of plagioclase and rock fragments randomly set in an extremely fine-grained matrix.

Rock fragments comprise 40% of the rock. These range in size from less than .2 mm to 5 mm, and are subrounded and very irregular in shape. In composition the fragments range from porphyritic and trachytic-textured andesite to fine-grained volcanic breccia. The matrix of the fragments is almost opaque in thin section, and consists largely of extremely finely divided hematite, which is responsible for the red color of the fragments in hand specimen. Feldspars are clouded with the alteration products sericite, epidote, and minor hematite.

Plagioclase crystals between .2 and 1 mm form 5% of the rock. The plagioclase (andesine) generally occurs as euhedral laths. The plagioclase is cloudy as a result of partial alteration to very fine-grained sericite, epidote and clinozoesite (?).

The matrix forms 55% of the rock. It consists of very fine-grained feldspar, minor chlorite and weakly birefringent material that is probably re-crystallized volcanic ash. About 12% of the matrix consists of hematite grains a few microns in diameter that are evenly disseminated throughout the matrix. Minor amounts of other opaques are also present.

About 1% of the rock consists of round to elongated vessicles about 1 mm in diameter. A very few of these are rimmed with hematite and contain minute crystals of a zeolite in their interior.

The rock is a medium-grained volcanic breccia. Alteration of the feldspar to epidote and sericite has been strong ; feldspar in the rock fragments is not more altered than that in the matrix. The alteration, including the introduction of abundant fine-grained hematite appears to be moderately strong deuteric.

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SPECIMEN ZA-29 : Tuf rouge - Unité 2

Hand specimen : The specimen is an aphanitic, red-brown, volcanic rock containing about 2% plagioclase phenocrysts, rare small fragments of foreign volcanic material, and rounded to irregular brownish patches of epidote.

Thin section : The matrix of the rock is microcrystalline to fine-grained and consists principally of quartz and feldspar. No mafic minerals were observed. Scattering of finely disseminated opaque material, probably hematite, gives rise to the reddish brown colour of the rock.

Plagioclase phenocrysts (albite) make up about 3% of the rock. They are commonly laths about 0.3 to 0.6 mm long.

Foreign fragments comprise about 10% of the rock. These are angular pieces of volcanic rock up to 1.4 mm long.

About 2% of the rock is thin veinlets of fine-grained quartz and epidote that have formed largely by replacement and consist of a fine-grained mosaic of quartz with erratically distributed anhedral to subhedral masses of epidote. Epidote also occurs distributed erratically through the specimen and as a replacement of plagioclase phenocrysts.

The rock is of tuffaceous origin and has been epidotized and silicified somewhat.

SPECIMEN ZA-31 : Tuf andésitique - Unité 1

Hand specimen : The specimen is a dark grey, fine-grained to aphanitic volcanic rock with about 20% irregular patches of yellow-green epidote. Patches consist of fine, anhedral granules, but patches themselves are up to 1 cm or more in diameter.

Thin section : The rock is of tuffaceous origin. Fragments range from cryptocrystalline to about 0.3 to 0.5 mm diameter. Shapes are irregular but in coarser grains corners are rounded whereas finer grains are more angular. Angularity and poor sorting indicate little transport of grains. Fragments are mainly plagioclase grains that are subangular and are epidotized to varying degrees. Opaque minerals are scattered throughout as fine anhedral grains and as thin coatings on many feldspar fragments.

Epidote is abundant, about 20% of the rock, and occurs as scattered masses up to 1 mm in diameter and as small anhedral disseminations. The large patches mostly have "hazy" rather than sharp borders and have formed by extensive metasomatism. The only other sign of alteration is slight sericitization of a few plagioclase grains.

The rock is an extensively epidotized tuff.

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SPECIMEN ZA-32 : Andésite rouge - Unité 2

Hand specimen : The rock is an amygdaloidal volcanic rock with grey aphanitic matrix and about 8% amygdules from a few mm to 1.5 cm long. Quartz, chlorite and epidote fill amygdules. Slight effervescence when treated with HCl.

Thin section : The rock is principally a microcrystalline assemblage of plagioclase laths with pronounced trachytic structure, 10% disseminated grains of opaque minerals (largely interstitial), and about 3% minute interstitial grains of calcite. About 8% of the rock is amygdules which are described below, and about 1-2% minute granules of epidote. A few small phenocrysts of plagioclase were observed.

Amygdules are mostly 1 to 2 mm diameter, but some are up to 1.5cm long. Most are elliptical in cross-section. Chlorite was the first mineral deposited in amygdules and most small amygdules are filled with chlorite and nothing else. A few of the smaller amygdules have rims of chlorite and cores of quartz. Very large amygdules tend to have a thin rim of quartz, an intermediate zone of epidote with minor calcite, and a relatively large core of quartz.

The rock is an amygdaloidal andesite that is weakly carbonatized.

SPECIMEN ZA-33 : Andésite gris-vert - Unité 2

Hand specimen : This is a dense grey-black rock composed of 1 mm grains of white plagioclase (12%) set in an aphanitic matrix. No directive textures are present, and there is no apparent alteration or mineralization. Several very tight fractures are filled with a white mineral. The rock is strongly magnetic.

Thin section : The rock consists of plagioclase phenocrysts (10%) set in a matrix of plagioclase, magnetite and chlorite.

Euhedral phenocrysts of plagioclase between 1 and 3 mm in diameter are set in a matrix consisting largely of smaller unoriented tabular plagioclase crystals. Both the phenocrysts and the matrix feldspar have been strongly altered to a mixture of clinozoesite and sericite.

Original mafic minerals have been largely destroyed. Irregular aggregates of sphene, magnetite, chlorite, epidote and pyroxene are all that remain of what were originally pyroxene phenocrysts. Minor chlorite is also present in the matrix.

Opaques : Minute grains of magnetite about .05 mm in diameter are scattered evenly throughout the thin section, and form about 8% of the rock. Several small grains of hematite were also noted.

The rock is a volcanic flow of probably andesitic composition. Alteration (mainly epidote and chlorite) has been strong but is probably only deuteric.

One fracture .1 mm in width is filled with a mineral that is probably prehnite ; there are no associated metallic minerals.

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SPECIMEN ZA-34 : Diorite - Sud Calona showing

Hand specimen : A dense, dark green aphanitic volcanic with about 10% epidote amygdules (1 mm in diameter). There is no apparent alteration of mineralization. The rock is an amygdaloidal volcanic.

Thin section : The rock consists of fine-grained plagioclase laths set in a chloritic matrix. Amygdules of quartz, epidote, and chlorite comprise about 10% of the rock, and are about 1 mm in diameter.

Plagioclase : Unzoned laths of plagioclase up to 2 mm in length constitute 40% of the rock. The laths show no preferred orientation, and are of andesine composition. The plagioclase shows slight alteration to fine-grained clinozoesite. However, many of the larger grains have been partially or completely replaced by epidote. Sericite is virtually absent.

Epidote forms about 7% of the rock. It occurs as an alteration product of plagioclase and, more commonly, as the major constituent of epidote-chlorite-quartz amygdules, in which it usually forms the rim.

Chlorite is the major constituent of the matrix, and is responsible for the green color of the hand specimen. It forms about 50% of the rock. The original material of the matrix, including all original mafic minerals have been altered to chlorite and minor sphene. Chlorite is also a constituent of all amygdules.

Sphene (3%) occurs as very tiny grains, and has probably formed by the breakdown of the original mafic minerals.

Quartz (2%) is restricted to the amygdules, in which it forms the cores. It is unaltered.

Opaques are virtually absent.

The rock is an amygdaloidal andesite. The feldspar phenocrysts are epidotized but otherwise only slightly altered, while the matrix has been completely chloritized. The alteration appears to be the result of only moderately strong deuteric activity.

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