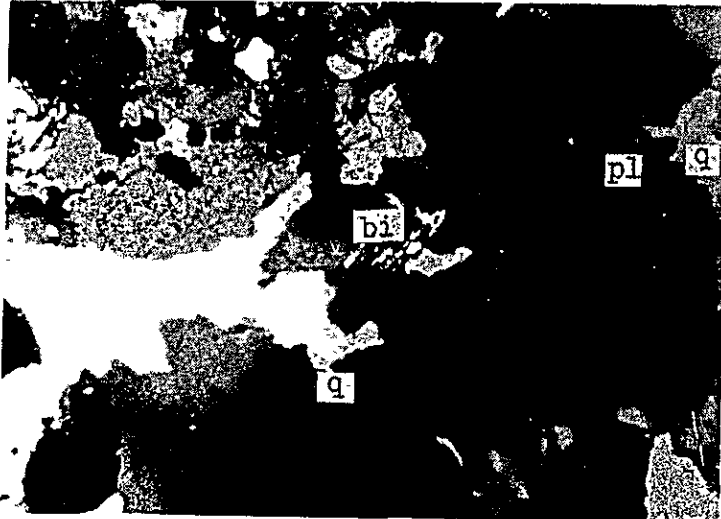


CO-38

No. 100302

Puerto Saldana area



Crossed Nicols

0 1 mm

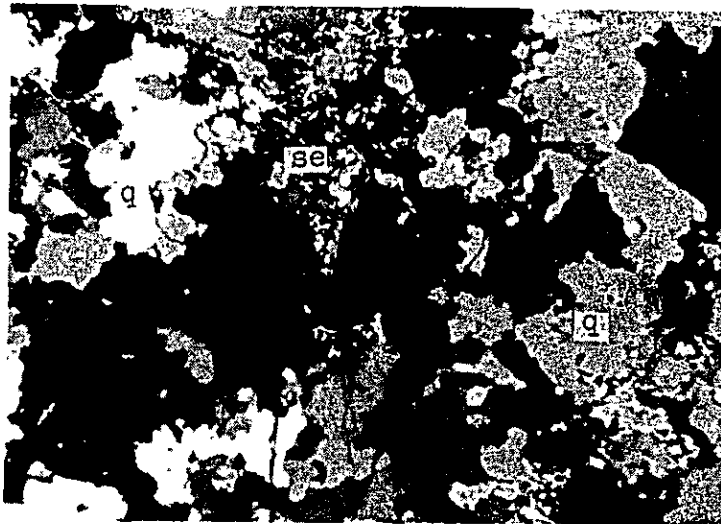
Granodiorite

This is slightly porphyritic, and moderate silicification and chloritization are observed.

CO-39

No. 100303

Puerto Saldana area



Crossed Nicols

0 1 mm

Porphyritic granodiorite

The rock is generally fresh. Small biotite (0.05-0.2mm) and quartz-sericite veinlets are observed.

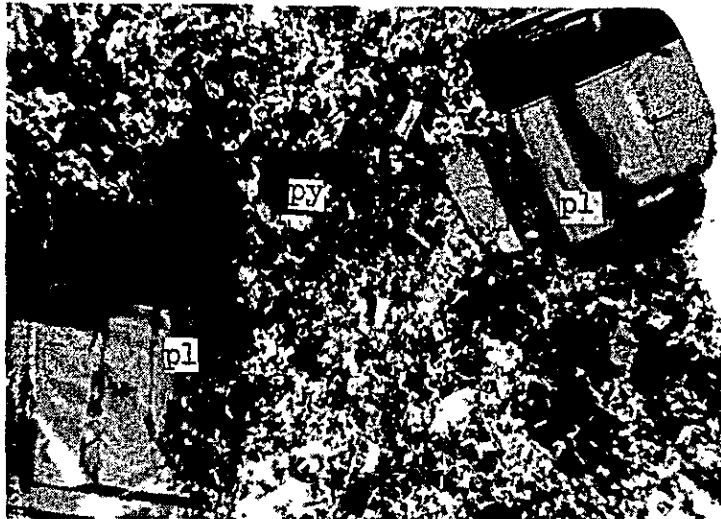


CO-41
No. 100306
Puerto Saldana area

0 Crossed Nicols 1 mm

Dacitic porphyry

Phenocrysts of plagioclase, quartz, and biotite; 1-1.5 mm in size, are observed in cryptocrystalline ground-mass with weak sericitization.



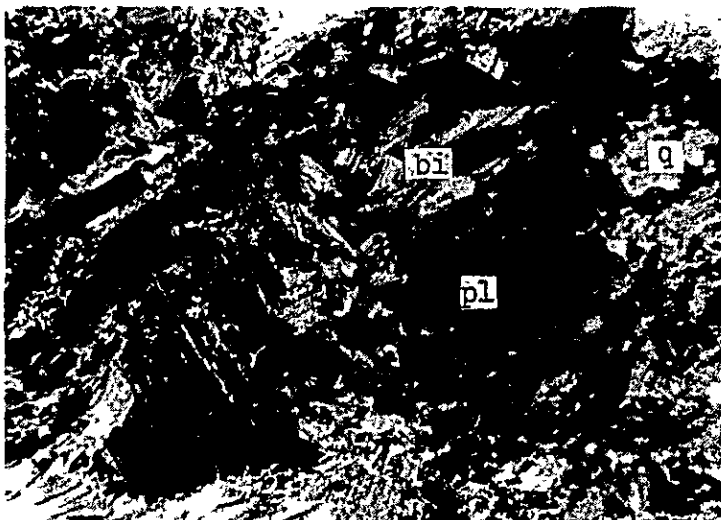
CO-42
No. 100307
Puerto Saldaña area

Crossed Nicols

0 1 mm

Dacitic porphyry

Phenocryst plagioclase showing Carlsbad twin and zonal structure is relatively fresh, although ground mass has suffered weak sericitization.



CO-43
No. 100401
Puerto Saldaña area

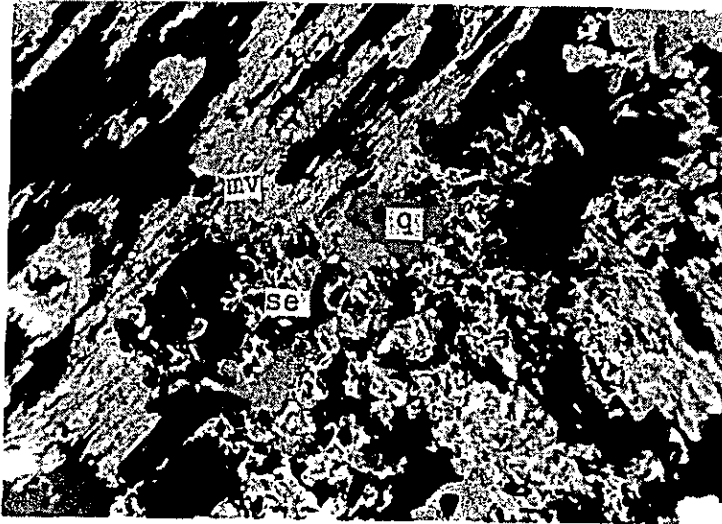
Crossed Nicols

0 1 mm

Biotite schist

The rock consists of 60-80% biotite, 25-15% feldspar, and small amount of quartz.

CO-46
No. 100903
Piedrancha area

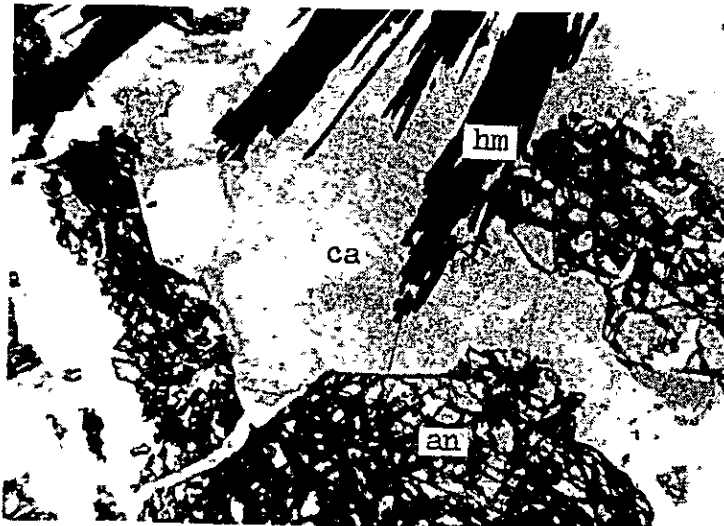


Crossed Nicols

0 _____ 1 mm

Acidic intrusive rock
Secondary muscovite is abundantly observed. Some sericitized plagioclase are recognized, however strongly altered.

CO-47
No. 100101
Mina Vieja



Open Nicol

0 _____ 1 mm

Cu skarn ore

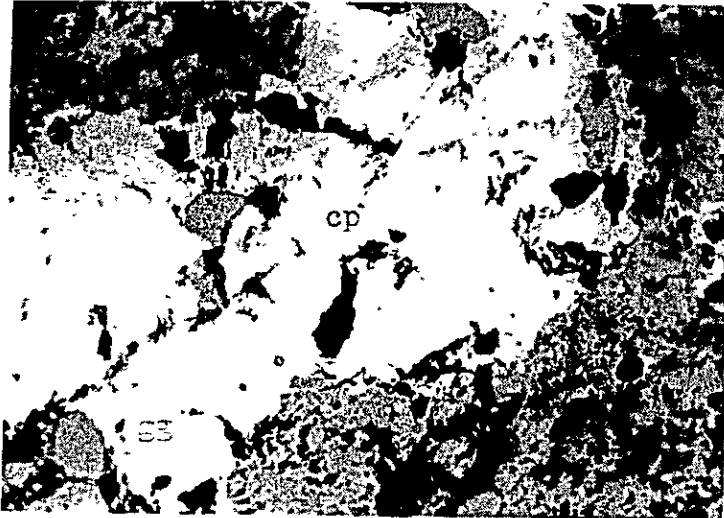
This consists of andradite, calcite and needle-like hematite are observed.

Fig-59 Photomicrographs of Polished sections

Abbreviation

| | | | |
|----|--------------|----|-----------------|
| py | Pyrite | ga | Galena |
| cp | Chalcopyrite | lm | Limonite |
| hm | Hematite | gg | Gangue minerals |
| sp | Sphalerite | mg | Magnetite |
| cc | Chalcocite | | |

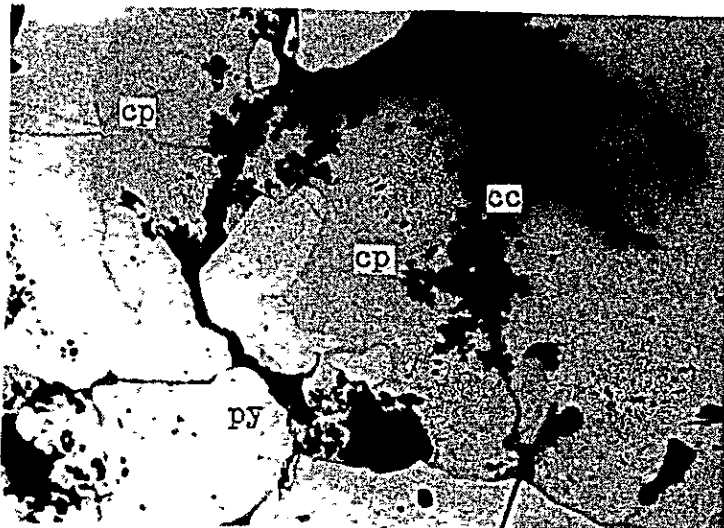
CO-13
No.092102
Pantanos area



Polished section

0.5 mm

Small piece of chalcopyrite is remained in oxidated porphyritic rock.



CO-15
No.P-Bo.5-129
Pantanos area

Polished section

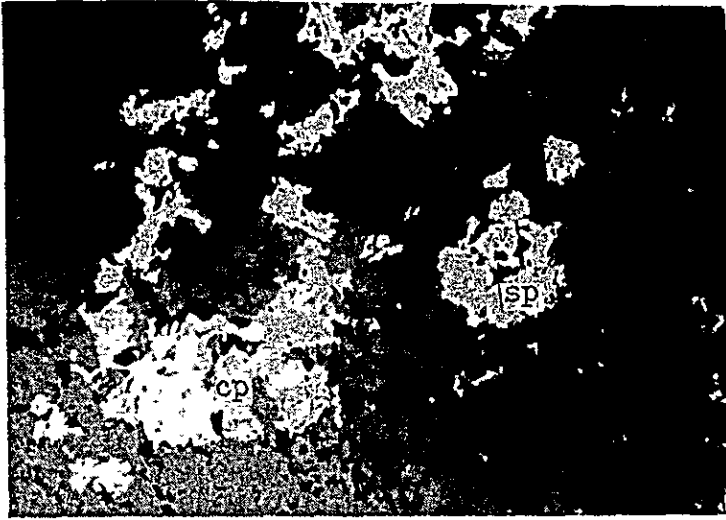
0.5 mm

Pyrite and chalcopyrite with chalcocite rim in the quartz veinlets.

CO-21

No.P-Bo.11-257.5

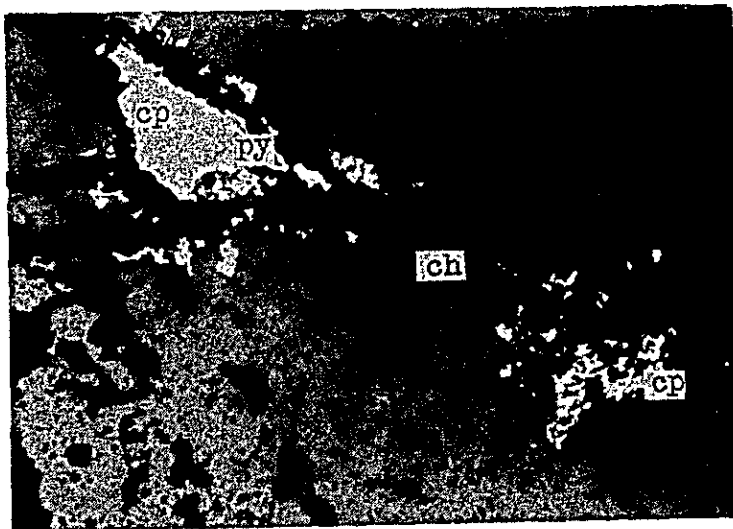
Pantanos area



Polished section

0.5 mm

Irregular shaped small spots of chalcopyrite, pyrite and sphalerite are observed associating and separating in particles.



CO-22

No.P-Bo.11-296

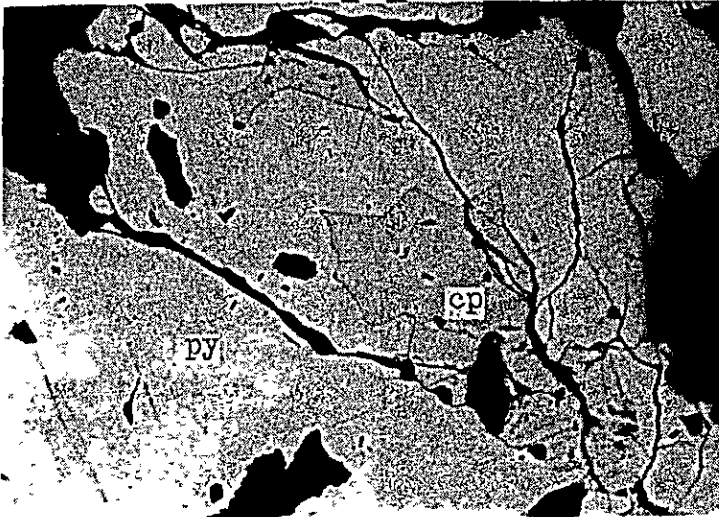
Pantanos area

Polished section

0 0.5 mm

Chalcopyrite-pyrite mineralization in the fine hair-like cracks and spots is seen, associating with chlorite in dioritic rock.

CO-27
No.PI-Bo.3-100
Infierno area



Polished section

0.5 mm

Pyrite in quartz vein includes small chalcopyrite.

CO-36
No.100202
Guayabos area



Polished section

0.5 mm

Chalcopyrite occurs associating with pyrite and magnetite, in the form of massive irregular aggregate or veinlets.

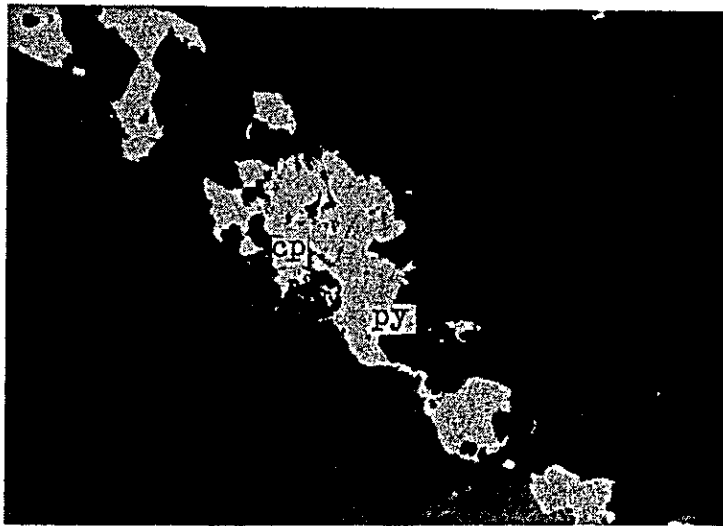


CO-39
No. 100303
Puerto Saldaña area

Polished section

0.5 mm

Pyrite with irregular form encloses small chalcopyrite.



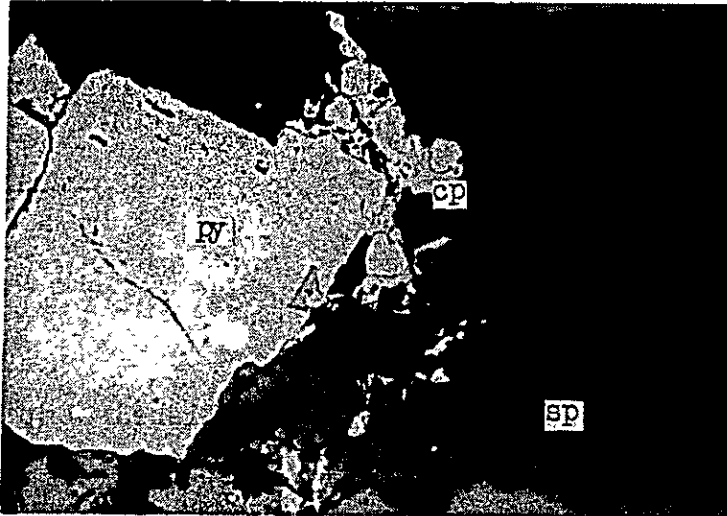
CO-45
No. 100902
Piedrancha area

Polished section

0 0.5 mm

Chalcopyrite associated with pyrite in quartz vein.

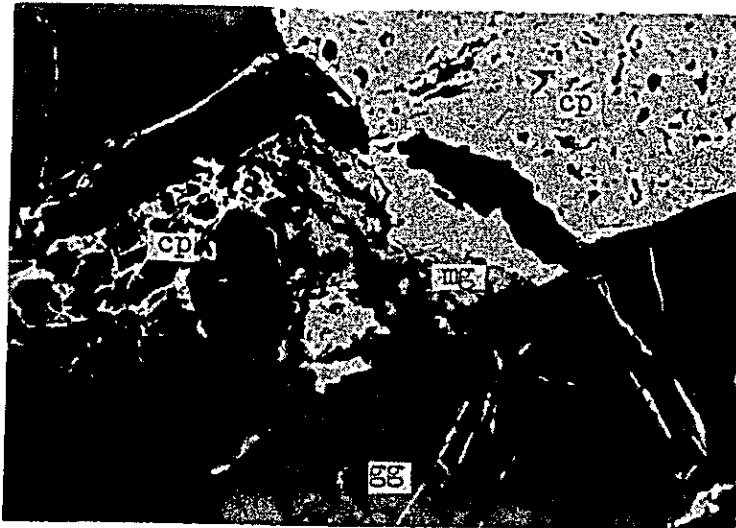
CO-46
No. 100903
Piedrancha area



Polished section

0 0.5 mm

The ore consists of pyrite, sphalerite, chalcopyrite, and pyrite. Small chalcopyrite are observed in sphalerite crystals.



CO-47
No. 100101
Mina Vieja

Polished section

0.5 mm

Big massive chalcopyrite and lesser amount of magnetite have crystallized among the garnet skarn, and chalcopyrite is observed in fine cracks of gangue minerals too.

MEMORANDUM OF VERBAL INFORMATION
同訳文：口頭中間報告のメラングム

Mr. Michel Hermelin
Director of INGEOMINAS
Bogotá, Rep. of Colombia

October, 15th, 1979, Bogotá

MEMORANDUM OF VERBAL INFORMATION

Introduction

Japanese mission surveyed four areas of Acandi, Pantanos, Rovira - Chaparral and Piedrancha where have been proposed by the government of Colombia for the cooperative basic survey of mineral resources between Colombia and Japan, from 9th September to 15th October, 1979.

In the above-mentioned areas, ground checking, collection of samples of country rocks, soils and stream sediments have been done. And, the mission have received some new information regarding those areas.

As it is necessary to require more time for examination of those data, the final technical evaluation report will be written later.

Meanwhile, the mission presents verbally herewith a tentative technical opinion.

The mission expresses its profound gratitude to the staffs of head quarter office, regional offices of Medellín, Ibagué and Popayán of INGEOMINAS, for their kind cooperation.

Tentative technical opinions on respective area

1. Acandi area;

Porphyry copper type alterations were recognized widely, but potassic alteration was very vague.

Cu-Mo mineralization was mainly observed near the boundary between phyllic and propylitic zone, however generally very weak.

It maybe approved that drilling exploration in 2nd phase of U.N.D.P. has been done in the central part of alteration and mineralization, therefore it will be very difficult to obtain new high grade mineralized zone in this adjacent area.

2. Pantanos area (including Murindo area);

In Pantanos area, being recognized porphyry copper type alterations, in generally it is predominant in phyllic or propylitic alteration. And potassic alteration zone will appear in deeper level.

Cu-Mo mineralization may be accompanied with quartz porphyry dykes intruded in NW-SE and E-W directions, and it is possible to concentrate the mineralization near the boundary of quartz porphyry and quartzdiorite.

Strong copper mineralization was observed on the No. 11 drilling cores.

The mission concluded that area is a very promising one for porphyry copper deposit.

However, by the reason of the relatively intensive structural control to the mineralization, it is strongly recommended to be done more basic investigations.

In the Murindo area, there are some large porphyry copper type geochemical and geophysical anomaly zones. It is expected to be promising mineralized area similar to Pantanos area.

3. Rovira - Chaparral area;

The mission inspected the four areas of Infierno, Los Andes, Guayabos and Puerto Saldaña, and the Vieja Mine for reference.

In the Infierno and Los Andes, porphyry copper type alteration with weak Cu mineralization was only observed along some fractured zones in quartz diorite.

The drilling exploration, it is acceptable, has been done in the most interesting part in this area. Consequently, around this part, it could not be found any other interesting part.

The Guayabos Cu mineralized indication is occurred in a fractured zone of calcareous beds of Post-Payande formation, and is associated with garnet-magnetite skarn.

It is possible to expect some ore bodies like as Vieja Mine's ore body based on future exploration. And also around the area, the similar mineralization should be expected.

In the Puerto Saldaña area, on the road of approximately 3 kms. it was observed relatively intensed biotitization, silicification and sericitization and weak Cu-Mo mineralization in some places of quartzdiorite, quartzporphyry and metamorphic rocks.

According to some skarnized floats in the rivers, it is presumed that some skarn type mineralization may exist in the area.

4. Piedrancha area;

The mission could not approach to the main geochemical anomaly area of U.N.D.P. 1st phase exploration results, because of bad weather. Therefore, the mission investigated only eastern and southern part, and studied geological data, mineral samples of "Zona Minera de Pasto", samples from a person of Piedrancha, and geological circumstance with geochemical anomaly of U.N.D.P.'s works. By the results of above-mentioned studies, Cu-Mo (plus Zu, Au) mineralized zones may exist in this area.

Conclusión

The mission presents verbally herewith tentative technical conclusions which are based on the results of only geological reconnaissances in this time.

The final technical evaluation report will be written after completing analysis of samples and examination of geological data.

It is advisable to carry out geological investigations in the following order based on the above mentioned technical opinions, for technical cooperation works between Colombia and Japan.

1. Pantanos area;

At first, geological and structural investigations in detail, systematic geochemical (soil) and geophysical (I.P.) investigations are favorable to select target areas. At second, information drillings must be done in the target areas.

2. Murindo area;

Geological and structural investigations, and more systematic geochemical and geophysical surveys where they are required, should be necessary to pick up the most promising zone. And finally, information drillings shall be done in the target area.

3. Puerto Saldaña area (Southwestern area of Chaparral);

It is required to make topographic map at first, and regional geological and structural investigation must be followed. For the hopeful area by those investigation works, information drillings shall be carried out.

Because of expecting to be similar mineralized areas around this project by the result of U.N.D.P. 1st phase survey, a regional geological investigation may be effective.

4. Piedrancha area;

The mission recommends a regional geological survey and geochemical prospecting with topographic survey by handy teodolite, and it should be followed by detailed geological survey, geological and geochemical investigations, and information drillings.

5. Guayabos area (Northern area of Chaparral);

It is recommended to effect a regional geological survey and study of skarn copper mineralized zone in detail. After those works, geophysical investigation (magnetic survey, and/or I.P.) and information drillings.



Japanese survey team for mineral resources
on Republic of Colombia.

〔訳文〕

1979年10月15日, ボゴタ市

口頭中間報告のメモランダム

緒言:

日本鉱物資源調査団は、コロンビア—日本間の鉱物資源開発協力基礎調査の対象候補地域として、1979年9月9日～10月15日の間コロンビア政府より要請のあったAcandí, Pantanos, Rovira-Chaparral および Piedrancha 計4地域の現地調査を実施した。

調査は主要鉱化帯に対するグラントチェックング、岩石サンプリングおよび地化学探査試料(土壌、河川堆積物)の採取等を実施した。採取諸試料は調査団が日本帰国後に分析・鑑定する予定なので、上記各地域に対する最終的技術評価は後日になるが、現時点で得た資料等から調査団として考えている暫定的技術見解をここにメモランダムにより御報告します。尚、本地域の調査は Ingeominas 本部および Medellín, Ibagué, Popayan 3支局の全面的御協力を得ることが出来て順調に終了しました。ここに厚く御礼申し上げる次第です。

各地域に対する暫定的技術見解:

1. Acandí 地域

広範囲にポーフイリー・銅型変質が認められるが、Potassic帯は不明瞭である。Cu-Mo 鉱化は phyllic 帯および propylitic 帯の境界部附近に多く観察されるが、全体的に弱い。

UNDP第2期で実施された試錐は、概ね鉱化・変質帯の中心部に行われていると判断され、今後本地域の調査において高品位鉱化帯を捕捉することは難しいと思われる。

2. Pantanos 地域 (Murindó 地域を含む)

Pantanos 地域には、ポーフイリー・銅型変質が認められるが、全般的に phyllic ~ propylitic 帯で、potassic 帯は下部に隠れている可能性が強い。Cu-Mo 鉱化は、NW及びEW系の岩脈状に貫入した石英斑岩に伴ったものと判断され、石英斑岩と被貫入の石英閃緑岩との境界部附近に濃集している可能性が強い。試錐№11孔には優良なポーフイリー・銅型 Cu-Mo 鉱化が認められ、ポーフイリー・銅型鉱床賦存有望地域と推定されるが、鉱化帯は構造規制を強く受けていると見られること、および深部に存在する可能性が強いこと等の理由で、今後更に基礎的調査を積み重ねる必要がある。

Murindó 地域には広範囲のポーフイリー・銅型地化学探査、物理探査異常帯が存在し、Pantanos 地域と類似の鉱化帯賦存地域として期待される地域である。

3. Rovira-Chaparral 地域

Infierno, Los Andes, Guayabos および Puerto Saldaña の4地域を調査, 参考として Vieja 鉱山を視察した。

Infierno, Los Andes 両地域は石英閃緑岩中にポーフイリー・銅型鉱化変質帯が認められるが, Cu 鉱化は破砕帯に伴って微弱に観察される程度で, 全体的に Cu 鉱化は弱い。

本地域でこれ迄に実施された試錐は, 概ね鉱化変質帯の中心部に行われていると判断され, 周辺部には新たに有望地は見当たらない。

Guayabos 鉱徴地は, 石灰質岩中の破砕帯に生成した含銅スカルン鉱化帯である。今後の探鉱によっては Vieja 鉱山程度の鉱床が期待される。又, 周辺部に同種の鉱化帯の存在が推定される。

Puerto Saldaña 地域には, 道路沿に約3Kmにわたり石英閃緑岩, 石英斑岩およびこれに貫かれる変成岩中にポーフイリー・銅型鉱化変質帯が認められる。

変質は, 黒雲母化作用, 珪化作用および絹雲母化作用が強く見られ, 弱い乍らも Cu-Mo 鉱化が一般的に認められる。

この他, 沢の中にスカルンの転石が存在することから, 貫入岩と変成岩との接触部にはスカルン型鉱化帯も推定される。

4. Piedrancha 地域

UNDP第1期の異常帯中心部附近には, 天候不良で入山出来なかったため, 地域周辺部の地質調査を実施すると共に, Pasto 鉱山局保有の諸資料サンプル, および現地村民所有のサンプルを観察した結果, 並びに UNDP による地化探図と地質図等を総合的に検討した結果では, 本地域内には Cu-Mo (+Zn, Au) 鉱化帯の存在が期待される。

結 論 :

最終的には帰国後の試料の分析・鑑定および収集資料等からの総合判断に依らねばならないが, ここに現地調査結果のみに基づく暫定的結論を述べる。

今回の調査に引き続き両国間の協力において実施されるべき調査対象地域としては, 先きの技術的見解に基づき, 次の順位において取り上げられることが望ましい。

1. Pantanos 地域

地質構造再精査, 系統的地化学探査(土壌), 物理探査(IP), およびこれらの結果に基づく構造試錐。

2. Murindó 地域

地質構造調査および既存の物理探査, 地化学探査資料の再検討。この結果に基づく部分的な系統的地化学探査, 物理探査調査。総合判断による第一ターゲットの抽出およびこれに対する構造試錐探査。

3. Puerto Saldaña 地域 (Chaparral 南西部地域)

地形図の作成。広域的地質構造調査。有望地域の抽出。有望地域に対する系統的地化学探査および物理探査。第一ターゲットの抽出およびこれに対する構造試錐。

Puerto Saldaña 地域周辺には、UNDP第1期の調査結果により、Puerto Saldaña 地域と同種の鉍化帯の賦存の予想される地域が存在するので、広域的調査の実施が望まれる。

4. Piedrancha 地域

簡易測量を伴った広域的地質・地化学探査調査。有望地域の抽出。有望地域に対する地質精査、物理探査、地化学探査。構造試錐。

5. Guayabos 地域 (Chaparral 北部地域)

広域地質構造調査およびスカルン鉍化帯の精査。有望地域に対する物理探査 (磁力探査, I P 探査) および構造試錐。

JICA