

BROWNS HALL PORPHYRY

COPPER - GOLD PROJECT

BHP Minerals International Exploration Inc.

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Browns Hall Porphyry Copper - Gold Project

BHP Minerals International Exploration Inc.

1) Introduction

The Browns Hall Porphyry Copper - Gold Prospect, located in the Central Inlier of Jamaica, was recognized by BHP Minerals International Exploration Inc. from follow-up of a regional stream sediment survey conducted by CIDA and the government of Jamaica. Special Exclusive Prospecting License #379 was obtained in July 1989. Due to the advancement of other projects, the area was not actively explored by BHP until 1992.

To date BHP has collected approximately 970 soil samples, 114 rock samples, 75 silt samples and conducted approximately 400 line kilometres of airborne mag, multi-channel spectrometry and VLF-EM. This work has identified three porphyry Cu-Au targets

The geology of the area is dominated by Cretaceous Arthur's Seat andesitic tuffs intruded by the granodiorites of the Cretaceous Ginger Ridge Stock and its numerous younger apophysis'. The intrusives occurred in several phases with the later more acidic, porphyritic phases representing the mineralizing events. These later phases include the Conners prospect, where an intersection of 89.3 metres at 0.69% Cu and 0.51 g/t Au was previously identified.

BHP's grid soil sampling over an area roughly 2 kilometres X 1 kilometre and encompasses several known Cu showings as well as coincidental geophysical anomalies. Results of this sampling have identified 2 broad multi-element anomalies capable of hosting significant porphyry copper - gold reserves. A third area of chalcocite occurring in volcanics is the other anomaly.

2) Location and Access

The Browns Hall license is located in the Central Inlier area of Jamaica approximately 50 kilometres northwest of Kingston. The area is centred on latitude 18°04' N and longitude 77°10' E near the St. Catherine - Clarendon Parish boundary. Location of the license is shown on Figure 1.

Access to the license area is via paved highway east from Kingston to Old Harbour then north, via paved country road, to Browns Hall. Few parochial roads lead from the main road however, the area is highly dissected by trails.

3) Physiography

The Browns Hall region is dominated by moderate to steep hills with elevations ranging from 200 to 800 metres. Numerous streams cut the area.

Small individual farms of mixed crops of coffee, chocolate, bananas and ground provisions occur throughout the area.

Annual rainfall averages 200 cm. with wet seasons from May to June and late September to early December. Wet season rain occurs as mid-afternoon, heavy showers.

4) License Status

The Browns Hall project is comprised of Special Exclusive Prospecting Licenses #379 which was granted in July of 1989. The status of S.E.P.L. #379 is summarized as follows:

S.E.P.L. #379

Date Granted:	July 17, 1989	
Granted To:	BHP-Utah International Exploration Inc.	
Location Beacon:	440 000N	500 000E
First Corner:	440 000N	520 000E
Second Corner:	410 000N	520 000E
Third Corner:	410 000N	500 000E

5) Regional Geology

The geology of the Eastern Central Inlier is dominated by the lower Cretaceous volcanic flows and tuffs of the Arthur's Seat Formation. Conformably overlying are shales and limestones of the early Campanian Peters Hill Formation. Unconformably above the Peters Hill Formation sit the andesitic and basaltic flows and tuffs of the mid-late Campanian Bull Head Formation - Main Ridge Volcanics. The Central Inlier Gold Project of Orvana Minerals (approximately 20 km. west of Browns Hall) is hosted by this unit.

This volcanic/sedimentary pile has been intruded by the Cretaceous granodiorite Ginger Ridge Stock. Numerous younger porphyritic dykes and plugs, possibly later phases of the Ginger Ridge Stock, occur throughout the area. Copper - gold mineralization is associated with these later phases and their attendant zones of hydrothermal alteration.

Eocene to Miocene limestones of the White and Yellow Limestone Groups formed onlapping the emerging volcanic pile. These occur in the southern and eastern portions of the project area.

The dominant structural feature in the region is the west-northwest trending Crawle River fault. This fault, along with its splays and related parallel structures, truncates the northwest trending fault set.

Regional geology is shown on Figure 2.

6) Property Geology

Due to the lack of outcrop, a preliminary geology map was compiled during comprehensive prospecting. Rocks were divided into five units, undifferentiated volcanics, granodiorite, felsic plugs & dykes, clastic sediments and limestone. Specific attention was paid to any hydrothermal alteration. The three primary phases of alteration identified on surface are as follows, quartz-sericite, sericite-clay, biotite-magnetite-quartz. Prospecting geology is shown on Figures 3 and 4 at 1:5,000 scale.

The volcanic unit is comprised of aphanitic to plagioclase phyric, green to black, andesitic and basaltic flows. Tuffaceous to cobble size volcanoclastic beds also occur. Flow banding has been noted by Jamaican government geologist at Blue Hole, however this could not be substantiated. Local variations in the unit are noted on the maps.

Small outcrops of sandstone occur sporadically within the volcanics. These are likely clastic members of either the Arthur's Seat or Bull Head Formations. As they occur intimately with in the volcanics, it is unlikely that they belong to the Peters Hill Formation.

The Ginger Ridge Stock, extending approximately 3.5 km. from Ginger Ridge to Conners, is an equigranular, medium grained granodiorite. Fenton, in her thesis, describes the composition as plagioclase (51%), quartz (25%), orthoclase (12%) and hornblende (8%) with minor biotite and magnetite. Volcanics in immediate contact with granodiorite have been intensely biotite - magnetite hornfelsed.

Numerous late stage dykes and plugs cut the volcanics and the granodiorite. These plugs and dykes differ from the main granodiorite body in that they are usually plagioclase phyric and

contain fewer mafics. Due to limited exposure and surface weathering, this unit is difficult to trace and is often confused for granodiorite or plagioclase phyric volcanics.

White limestone occurs along the periphery to the map area and represents the edge of the Central Inlier.

Alteration is primarily associated with the later intrusions and consists of pervasive quartz - sericite, sericite - clay and/or biotite - magnetite replacement. These alterations occur in both the volcanics as well as the intrusives where they are cut by the later intrusive phases. Pyrite, disseminated and fracture controlled, is common with both alterations, but often is leached due to surface weathering. Copper occurrences vary from small high grade showings, of malachite +/- chalcopyrite +/- chalcocite, to large coincidental soil anomalies and are associated with these later intrusives.

The main alteration zone discovered by BHP is the east west trending Kola Zone. Located near Woodhall, this 750 X 400 metre zone appears to have a quartz - sericite core surrounded by a sericite - clay halo with a biotite - magnetite outer shell. Interpretation of this zone is difficult due to limited exposure. Two copper showings within the zone are associated with a plagioclase porphyritic dyke.

Chalcocite was noted occurring in vugs within andesitic "flow rocks?" found north of Browns Hall. Based on preliminary investigations it is believed these are flow tops. The possibility of secondary enrichment remains. Rock sample results from this area are summarized on Figures 5 through 8.

7) Geophysics

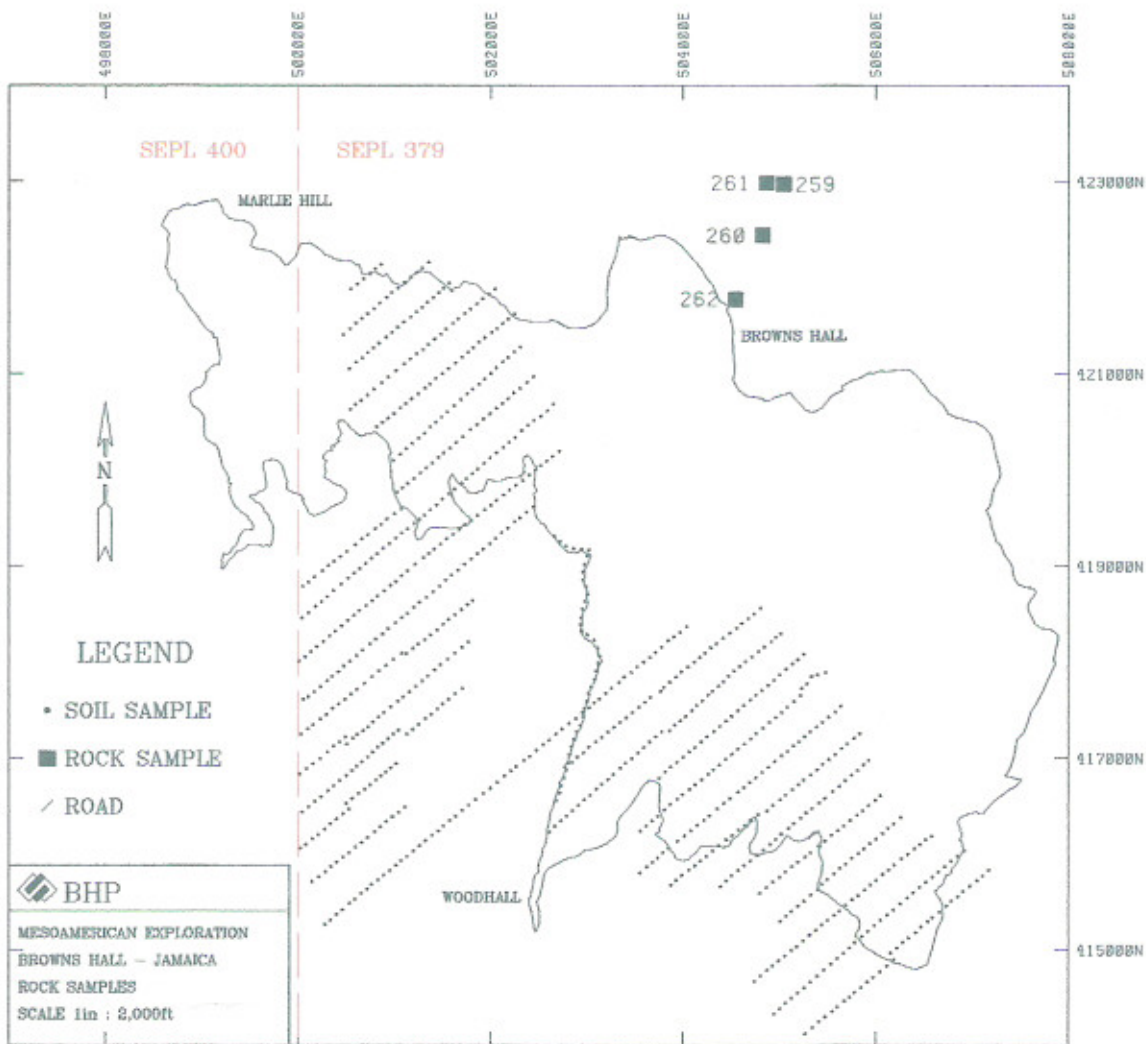


FIGURE 5

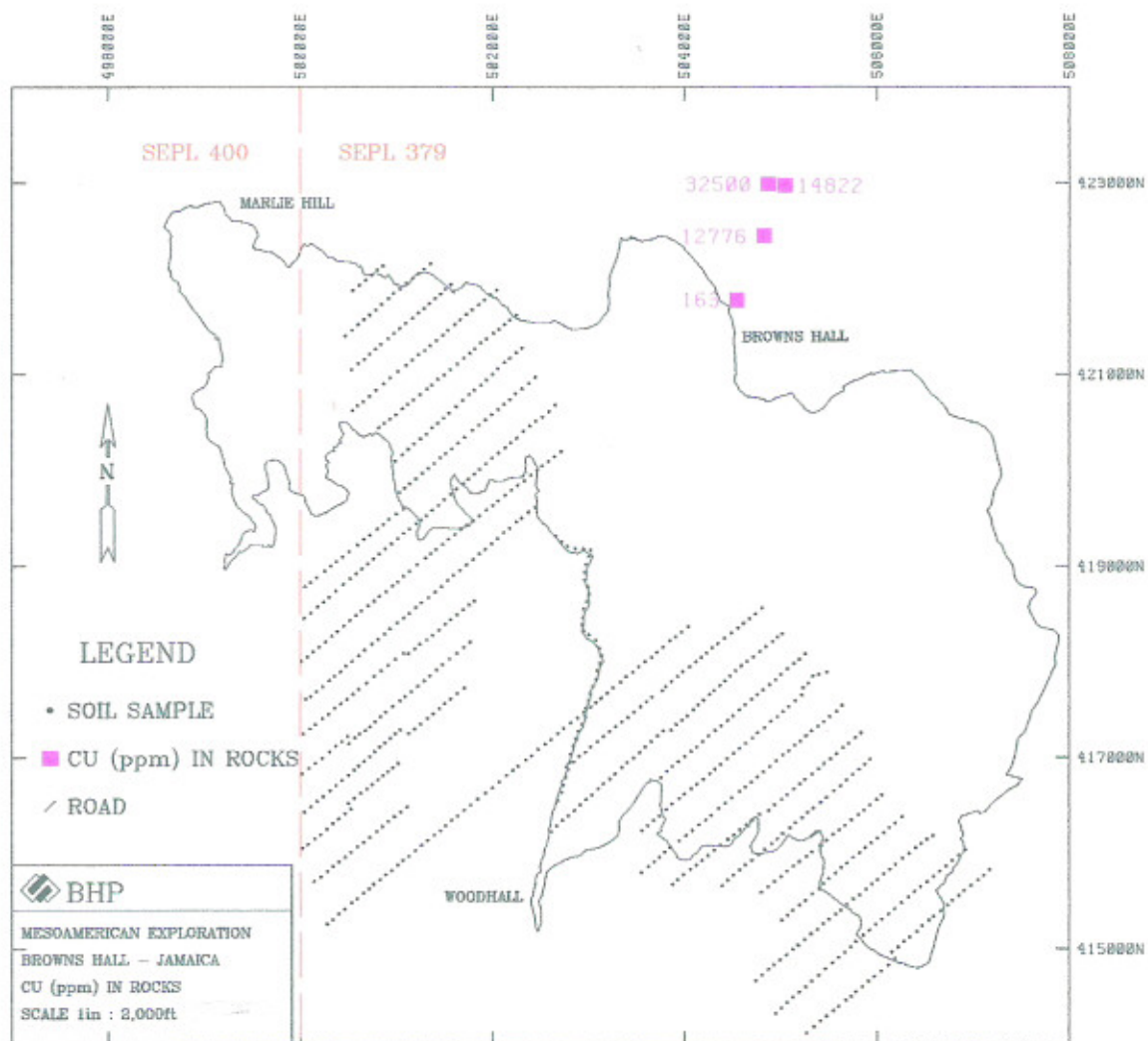


FIGURE 6

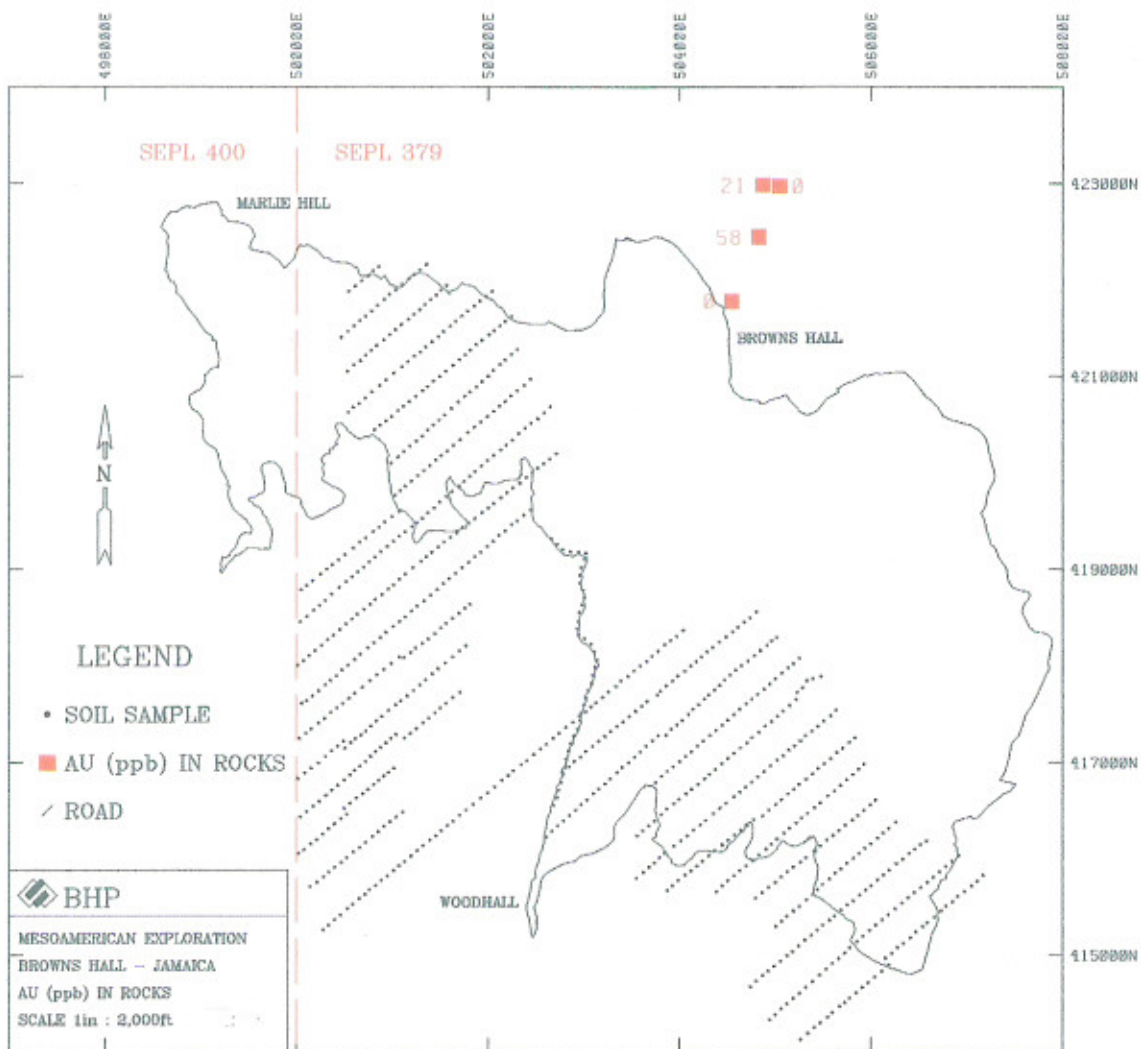


FIGURE 7

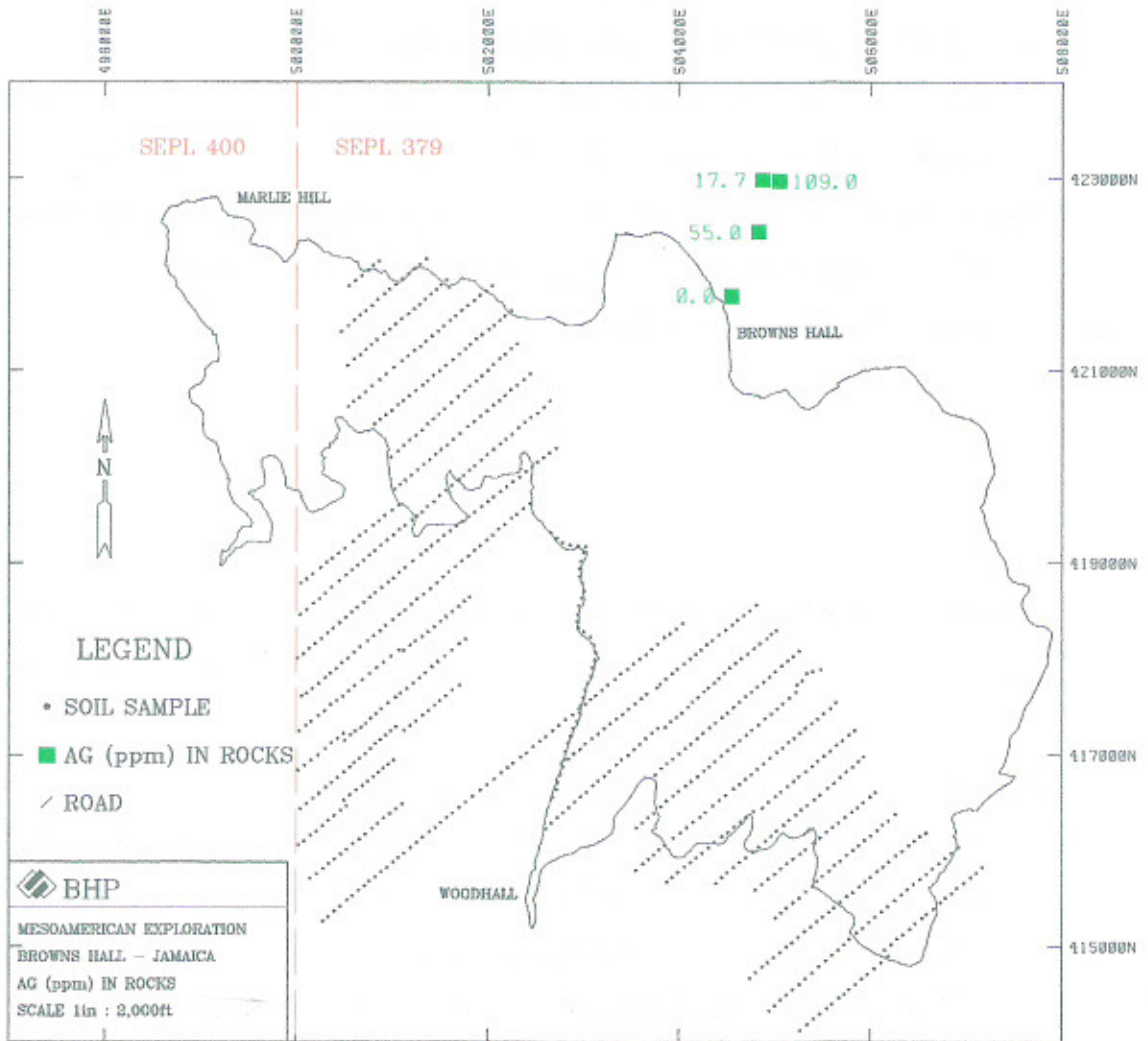


FIGURE 8

In 1992 BHP contracted BGM Airborne Surveys Inc. to fly a multi-channel geophysical survey over the eastern portion of the Central Inlier. The survey equipment included magnetometer, four channel spectrometer (total count, potassium, uranium and thorium) and VLF-EM (Panama and Annapolis). Specifications of both surveys are included as Appendix I.

Results of potassium spectrometry and reduced to pole magnetics revealed several coincidental mag lows and potassic highs. These could indicate potassic alteration accompanied by the destruction of magnetite. The largest of these anomalies occurs over the Ginger Ridge Stock. Field examination showed the K-spar content of the intrusive to be higher than the surrounding volcanics and the hornfels are strongly magnetic in contrast to the adjacent stock. Several smaller satellite anomalies however, are coincidental with geochemical anomalies and alteration zones (Kola Zone). Contoured magnetometer and reduced to pole magnetometer data are shown on Figures 9 and 10. Contoured total count and potassium spectrometry are shown on Figures 11 and 12.

8) Geochemistry

To date, BHP has collected approximately 970 soil samples, 65 rock samples and 75 silt samples. Analytical techniques are summarized in Appendix II.

Soils were collected on lines oriented 050° degrees at 25 metre intervals. Lines are spaced 100 metres apart. Due to the lack of horizon development, "C" horizon samples were placed in kraft paper envelopes and air dried. Samples were then oven dried and crushed at BHP's sample preparation facility in Kingston. A 250 gram split of was sent to Chemex Labs for pulverizing and analysis. Sample locations and results for Au, Ba, Cu, Pb, and Zn are shown at 1:5,000 scale on Figures 13 through 18. Soil sample results are attached as Appendix III.

Two major anomalies were identified. The first, is an area approximately 1 km. X 1 km. of greater than 290 ppm Ba anomalism with a high of 3750 ppm Ba (ICP analysis). Several samples within this area returned greater than 1000 ppm Ba and the anomaly is open to the north and the west. Coincidental, Pb greater than 45 ppm, Zn greater than 265 ppm, Mg greater than 1.3 ppm and Mn greater than 30 ppb anomalies are located within the Ba zone. The small, dyke related, high grade Weebar copper showings occur within this area.

The second zone identified is the Kola zone. An elongated, northwest trending zone approximately 500 metres by 200 metres of Cu greater than 215 ppm. Two smaller, parallel zones flank the central core. Gold values are sporadic with a high of 175 ppb and zones of anomalous Zn and Ba halo the Kola zone. Geochemical potassium and airborne geophysical potassic highs are coincidental with the Cu anomaly. The Kola zone narrows to the northwest but can be traced sporadically for an additional kilometre. Several high Cu values in rocks have been noted along this trend. Additional sampling is required to further define this extension.

Summaries of this metal zoning are shown on Figures 19 and 28.

Stream sediment samples were collected where soil lines intersected creeks and at regular intervals during prospecting. Data was used to further define and to check results of the regional CIDA/Jamaican government survey. Samples were collected in kraft paper bags then oven dried and sieved to -80 mesh at the BHP sample preparation facility in Kingston. ICP analysis was performed by Bondar Clegg and Chemex Labs in Ottawa, Mississauga or Vancouver. Stream sediment sample locations are shown with rock sample locations on Figures 29 and 30 and Au, Ba, and Cu results are shown on Figures 31 through 36. Stream sediment sample results are attached as Appendix IV.

Rock samples were collected from outcrops and float where evidence of mineralization or alteration was noted. Samples were oven dried then crushed at the BHP sample preparation

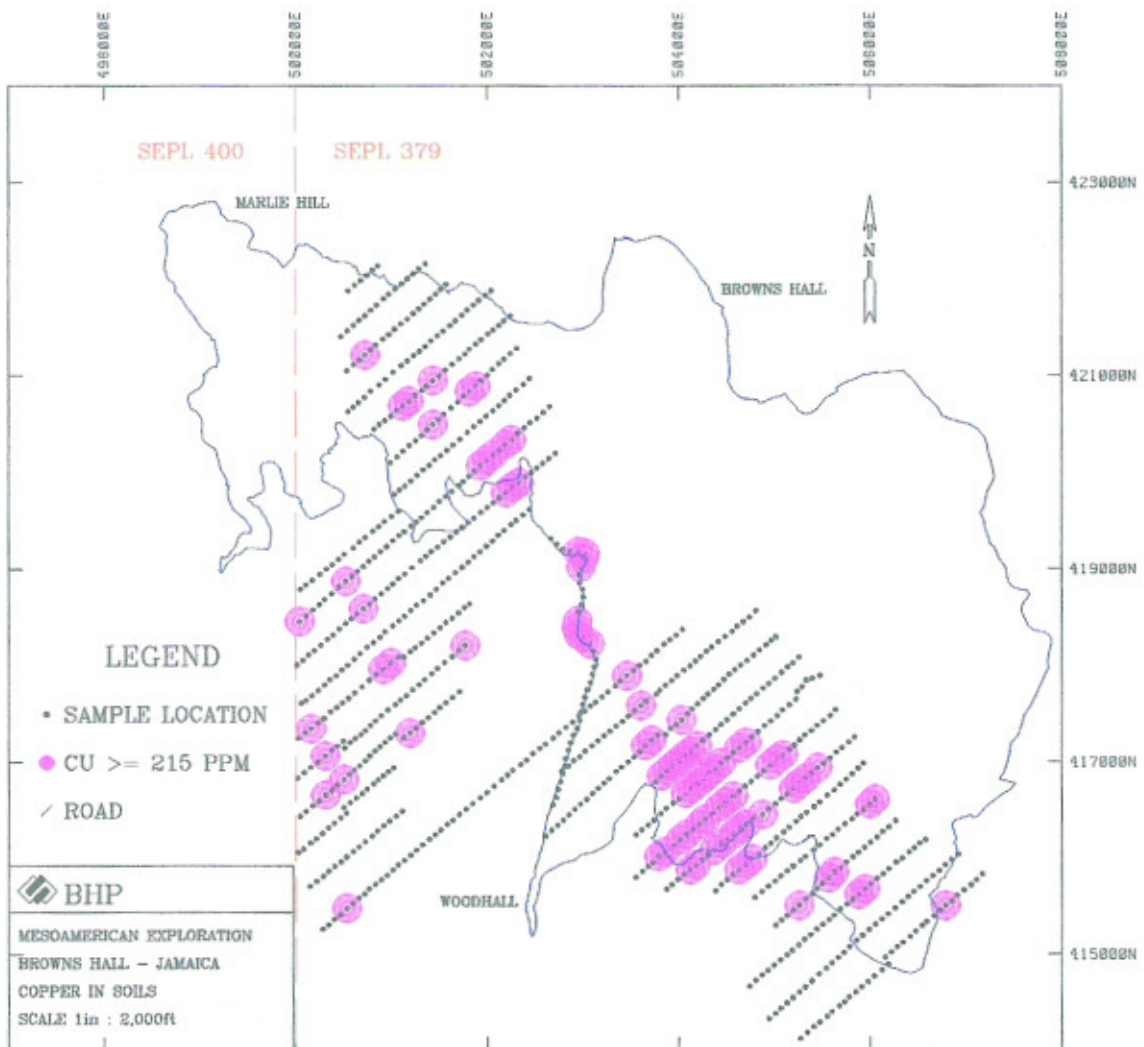


FIGURE 19

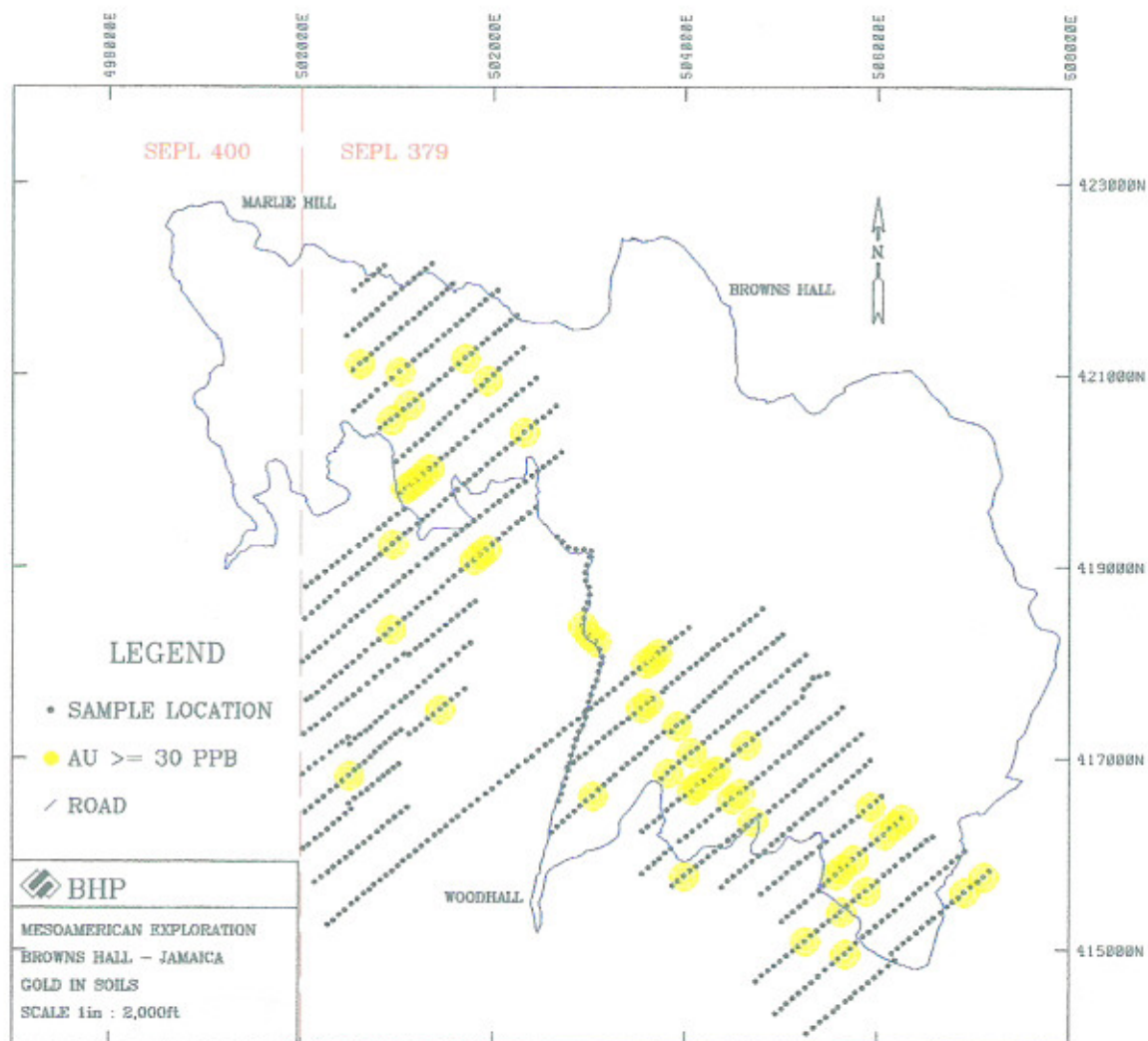


FIGURE 20

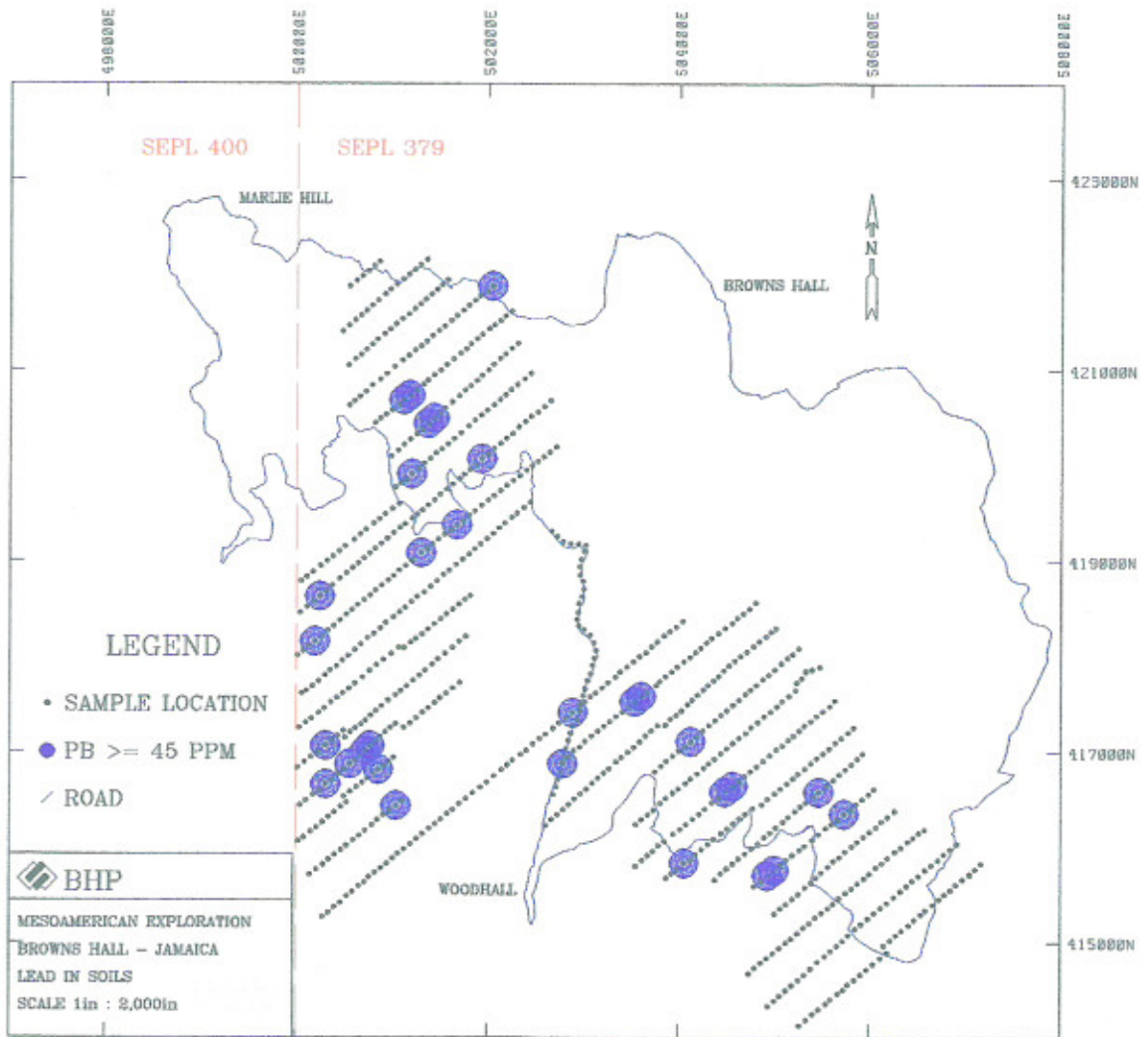


FIGURE 21

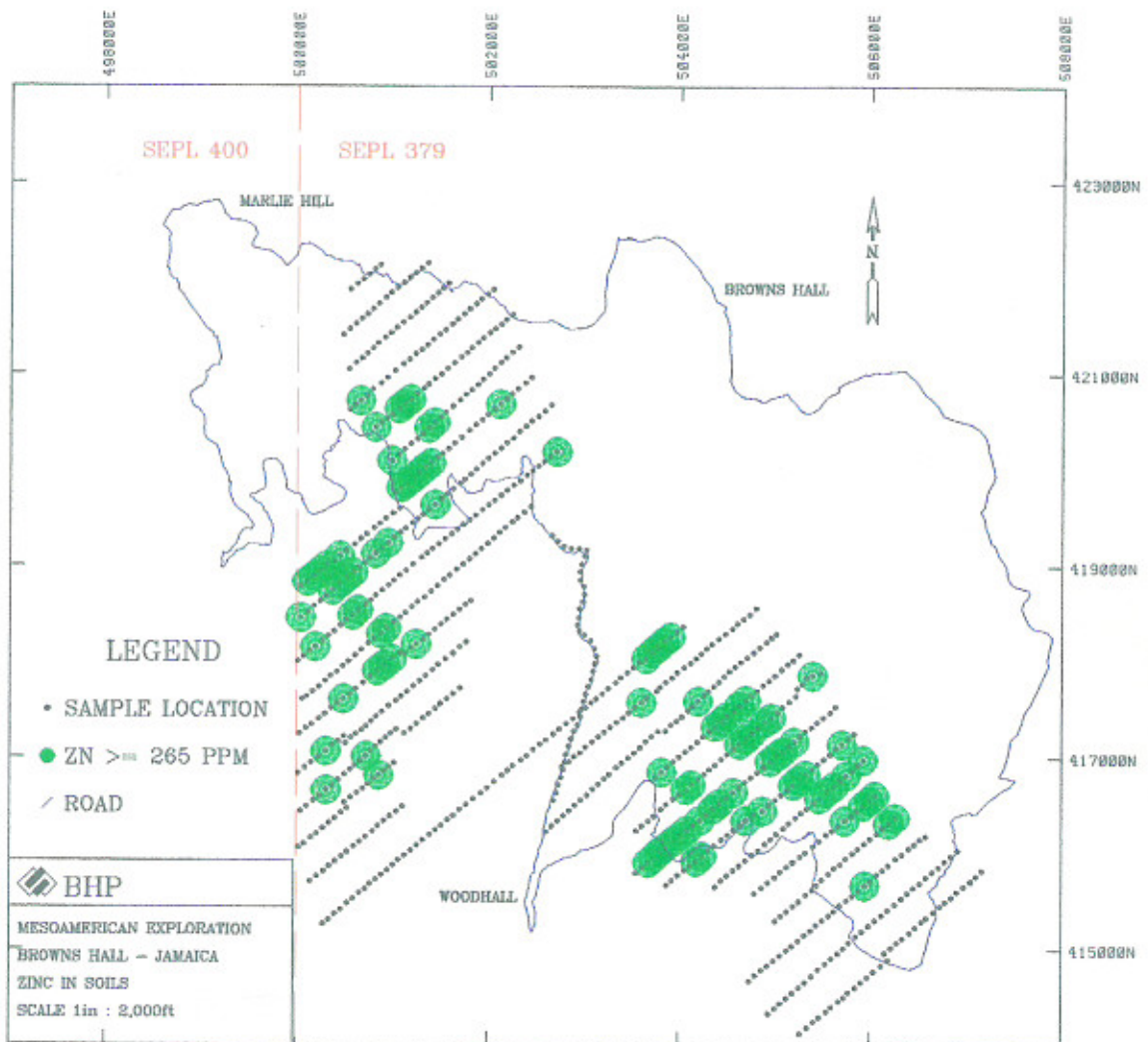


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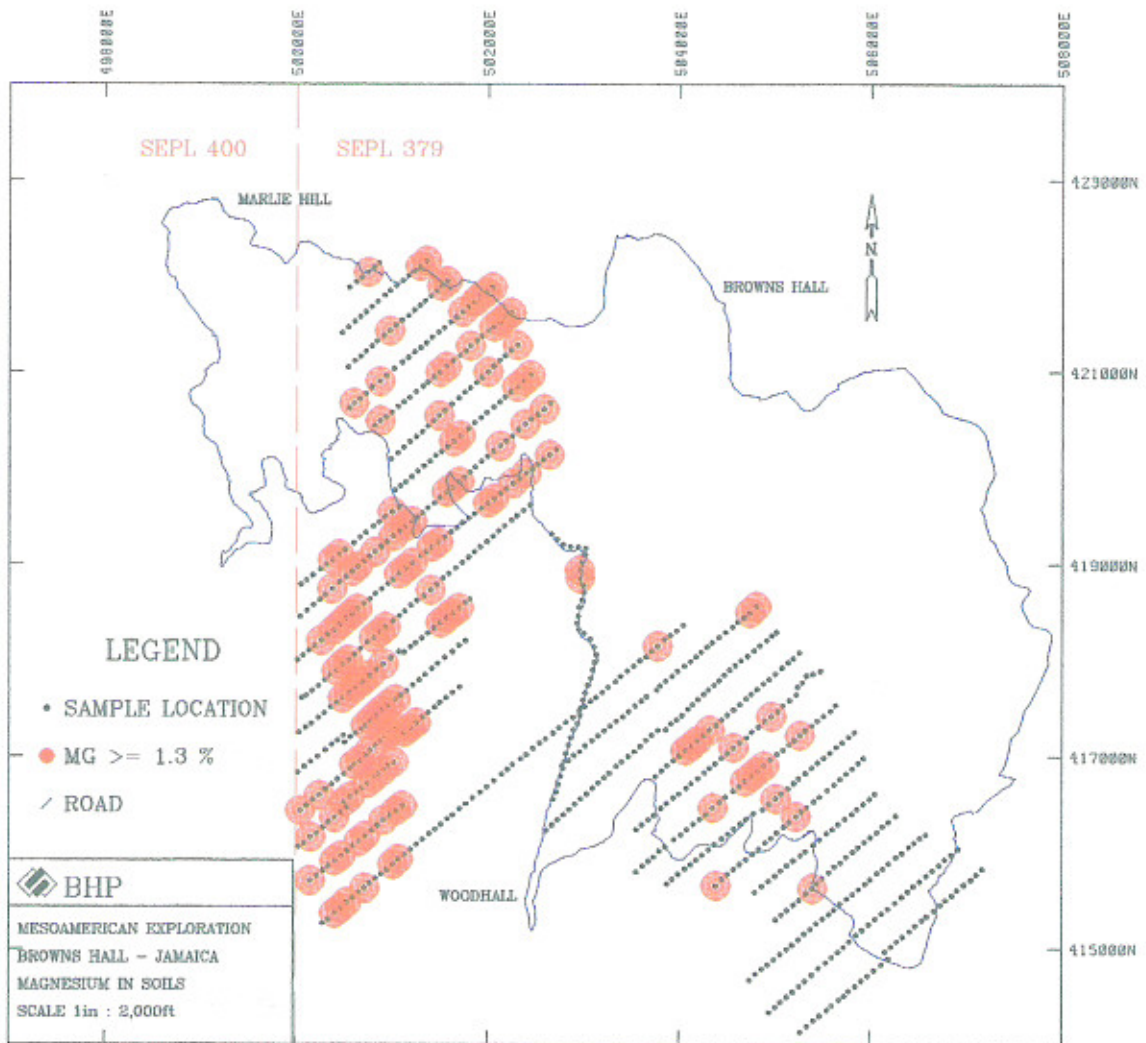


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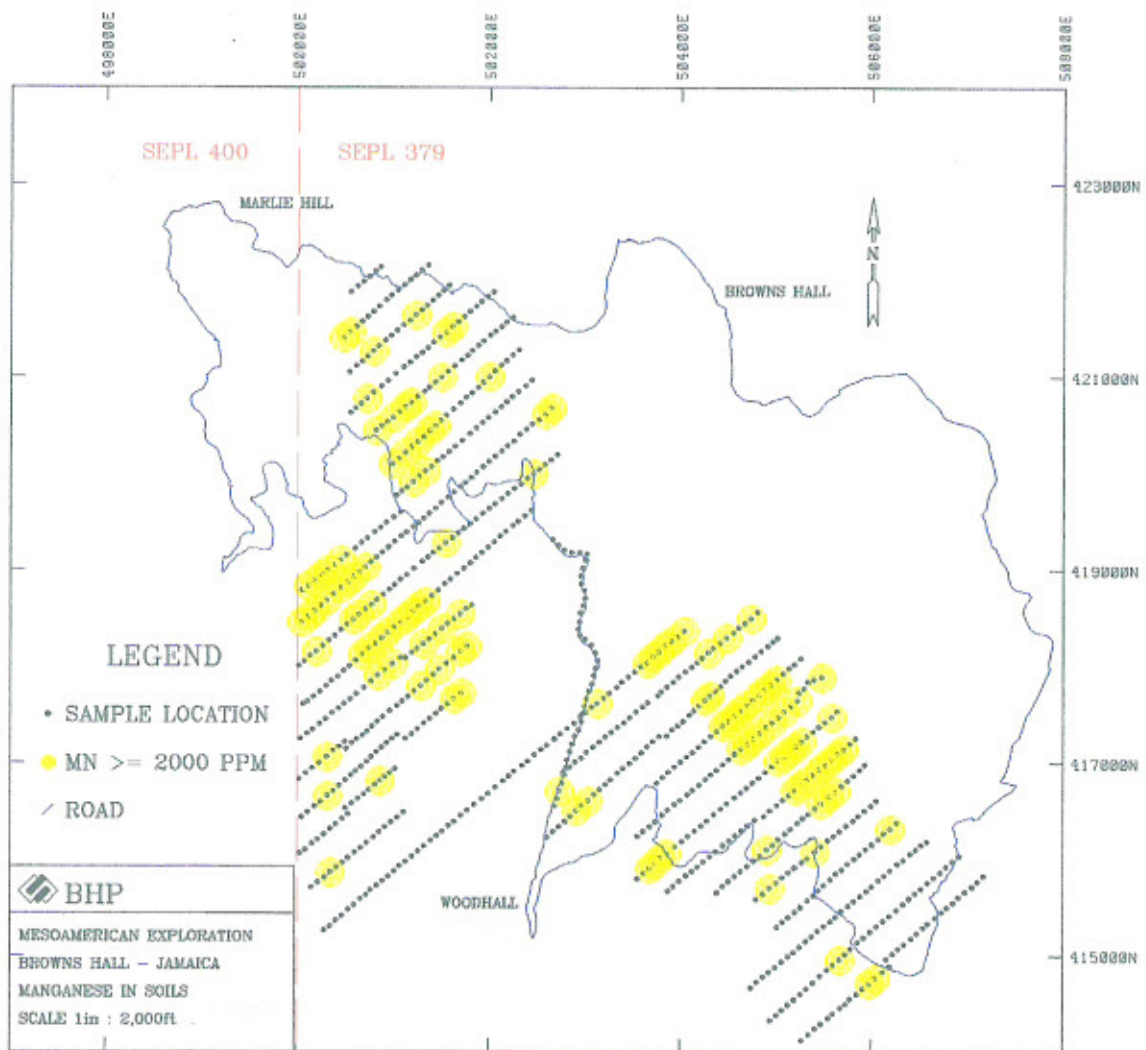


FIGURE 24

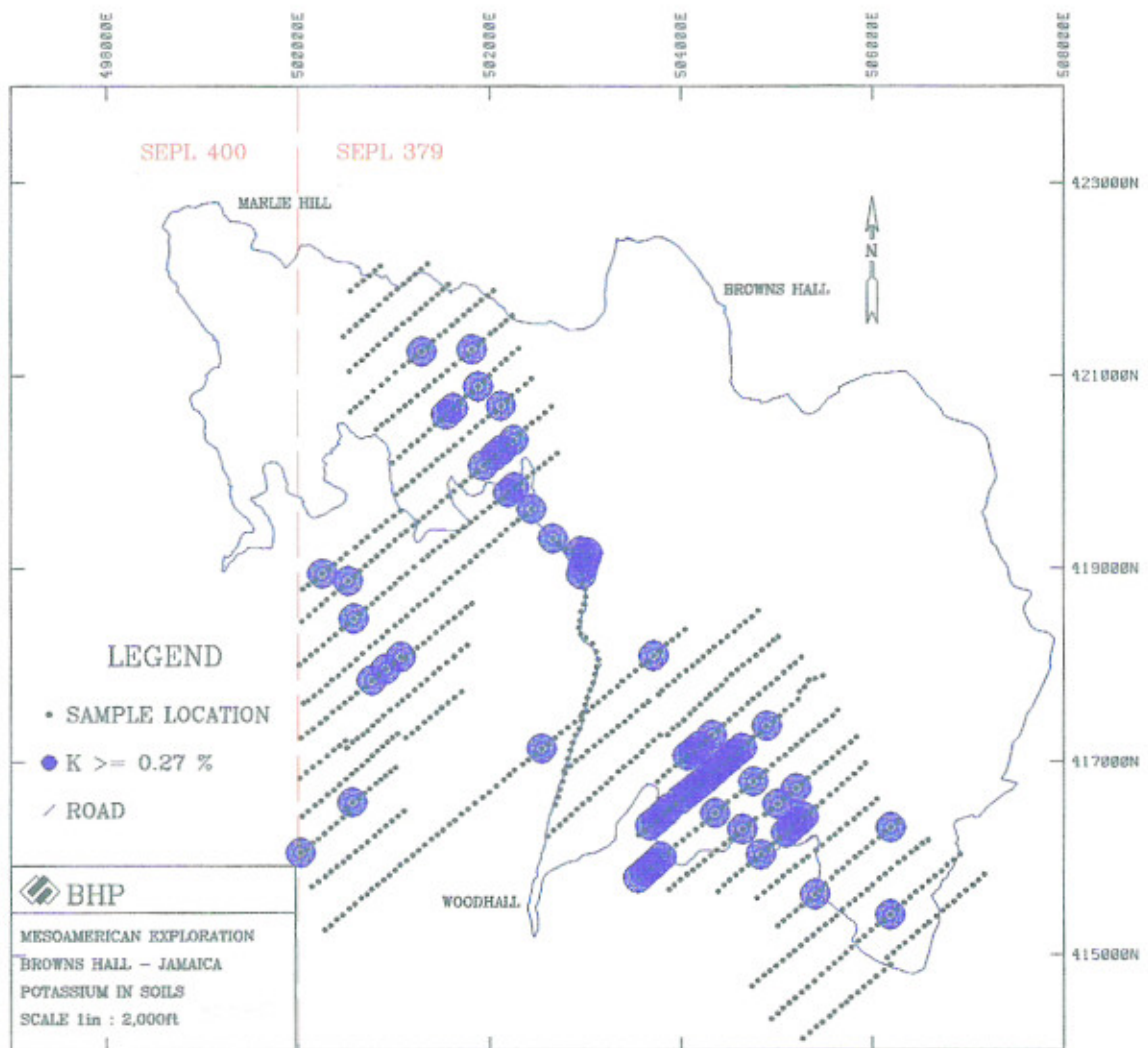


FIGURE 25

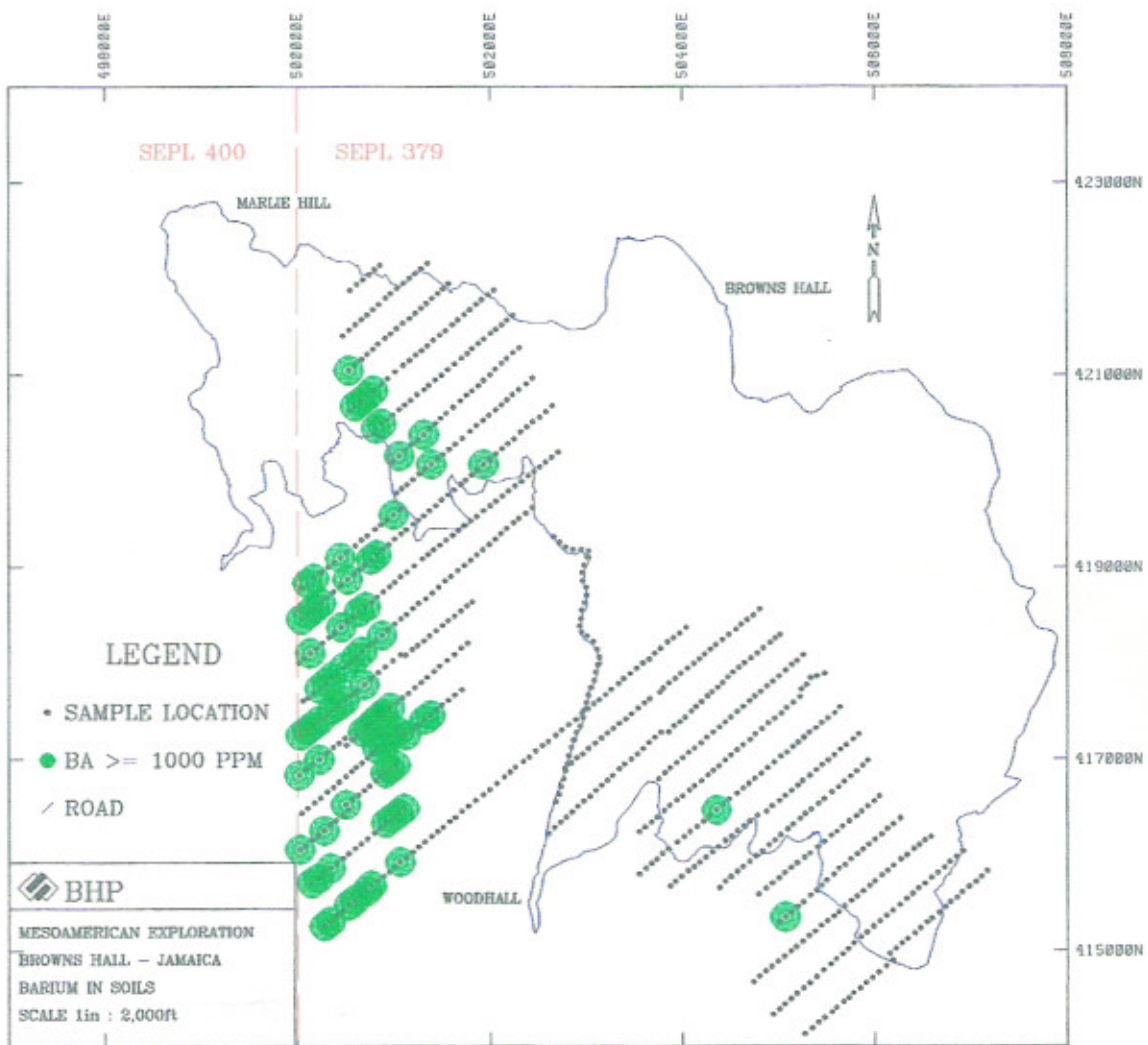


FIGURE 26

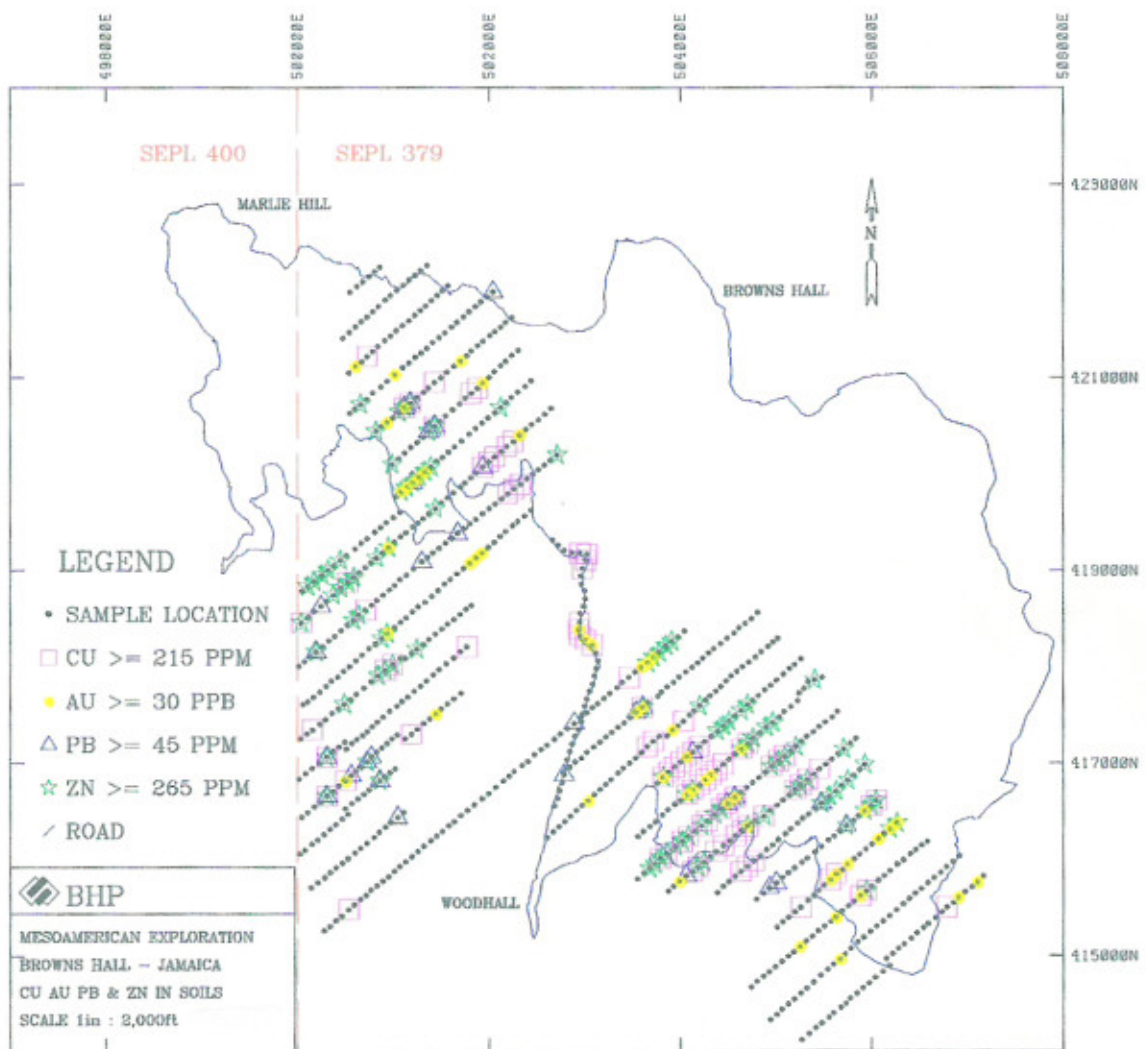


FIGURE 27

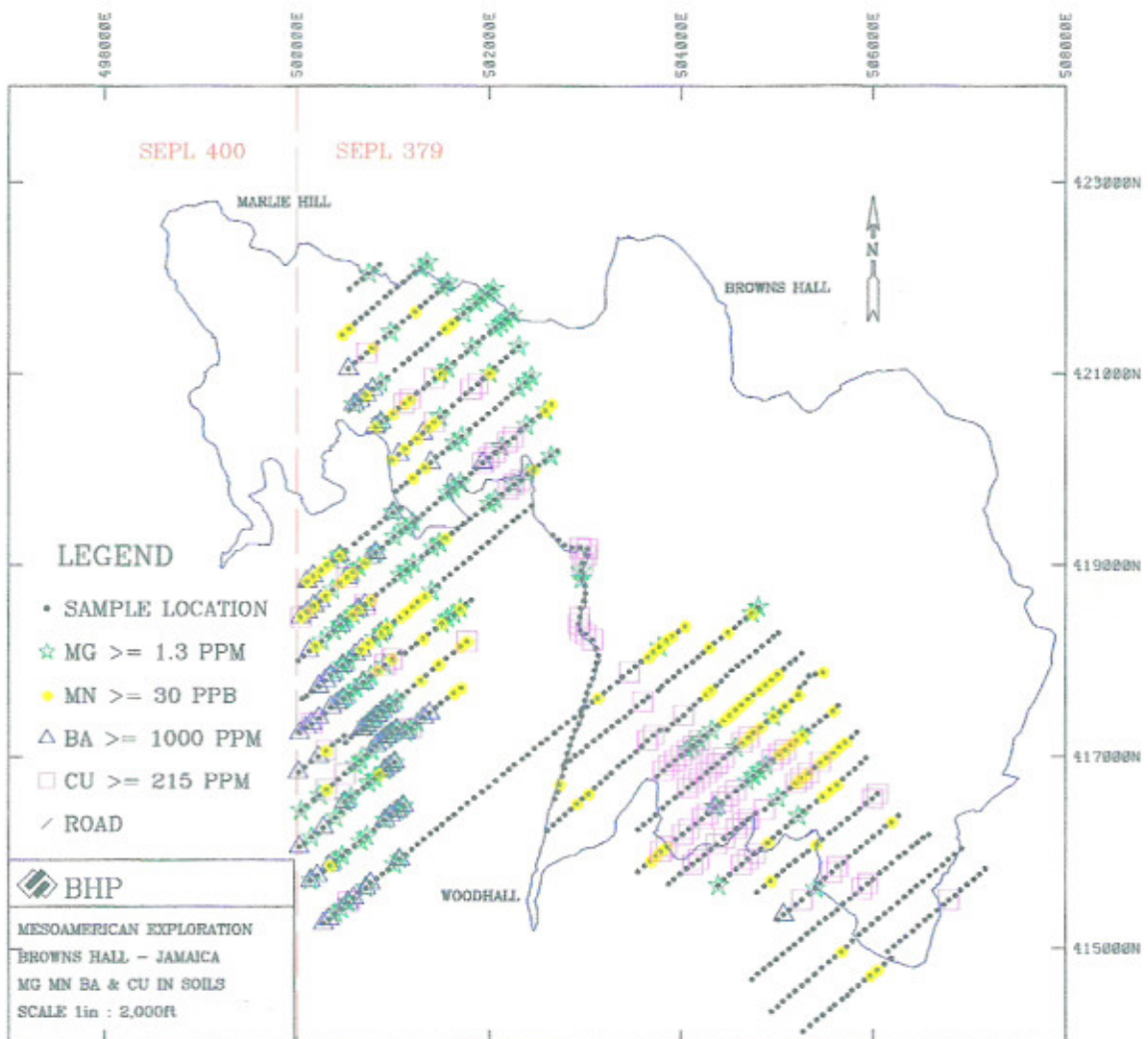


FIGURE 28

facility in Kingston with a 250 gram split sent for analysis to either Bondar Clegg or Chemex Labs in Ottawa, Mississauga or Vancouver. Rock sample results are attached as Appendix V.

Rock sample results generally reflect the anomalies outlined in soil sampling. Numerous local anomalous values of Au and Cu occur along the northwest trend of the Kola zone and are coincidental with sporadic soil anomalies.

Chalcocite occurs in several rock samples in an area north of Brown's Hall.

10) Discussion

Based on previous work to the west (Conners and Bull Snap) it is believed that the main Ginger Ridge Stock was emplaced at depth from the southeast and the later apophysis occur as "spikes" above this. The continuity of the potassic alteration in the Bull Snap Zone suggests that it is the root of a porphyry system. Therefore the systems further to the southeast would represent higher levels of the later intrusives and a stronger chance of preserving the mineralized system.

The wide spread Ba soil anomaly with its associated Pb, Zn, Mg and Mn anomalies at Weebar could represent the roof of a significant deposit. By examining the high grade, dyke related Cu showings in this area and vectoring in on where these dykes coalesce, the source of this mineralization may be located.

A similar scenario exists at the Kola zone, except that being 80 metres below the Weebar zone, erosion has exposed a large Cu soil anomaly and mineralized outcrops. The extensive geochemical zoning evident at Kola makes this zone an attractive target.

11) Recommendations

The extensive Ba, Pb, Zn, Mg and Mn anomaly outlined at Weebar warrants further exploration to define drill targets. Trenching is recommended on the Weebar showing and other nearby, similar showings, to determine an orientation so that drill targets can be defined. Drill holes on the Weebar showing would have to explore deep enough to reach the inferred buried Cu-Au system.

Drill targets could easily be defined at the Kola zone based on existing data. A series of angle holes from south to north across the Cu soil anomaly would test the grade and extent of this mineralization. The holes should be collared back from the alteration zone to intersect any contact mineralization as well as the core of the anomaly. By orientating the holes in a northerly direction they would cut across the inferred southerly plunge of the porphyritic intrusive.

The Woodhall soil grid should be extended to define the northwestern extent of the Kola soil anomaly and define additional drill targets.

The chalcocite occurrence north of Brown's Hall needs to be examined to determine if it represents an enriched zone. Soil sampling should be extended over this area to define its lateral extent.

12) Conclusions

BHP's work to date has outlined numerous targets capable of hosting significant porphyry copper - gold mineralization. Soil sampling has defined drill targets on the Kola Zone. Additional trenching over the Weebar should define drill targets in this area. Soil sampling and trenching are required northwest of Woodhall and north of Browns Hall to determine the extent of these anomalies.