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BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1960/119

THE IRON - COPPER LODES, SULOGA PENINSULA, WOODLARK ISLAND, PAPUA.

by

J.E. Thompson.

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Records 1960/119

CONTENTS

ILLUSTRATIONS.

THE IRON - COPPER LODES, SULOGA PENINSULA, WOODLARK ISLAND, PAPUA

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I. SUMMARY.

Copper-iron mineralization at Norac and Loluai on Suloga Peninsula occurs as sub-parallel bands of magnetite and hematite with local copper carbonate enrichments.

The lodes are invariably within and replacing coarse garnet - epidote rock probably derived by metasomatism from lenticular limestone members within a formation of indurated argillites, greywackes, basic tuffs and lavas. Granodiorite in the area may be the source of metasomatizing and mineralizing fluids.

At Norac, the two main lodes contain about 420,000 tons of possible ore-grade magnetite - hematite above sea level. Outcrops of these lodes are approximately 50 feet and 30 feet wide and have strike lengths of 500 feet and 350 feet respectively. They are close to the coastline and dip steeply beneath the beach, so that mining below sea level would be impracticable. Fracture coatings of copper carbonate in small localized portions of the lodes do not approach ore grade, though they may indicate copper sulphide enrichments at depth, probably below sea level. Assays of grab samples from old dumps of hand-picked lode material suggest a possible average grade of 50 - 55% Fe, 1.0% Cu, low silica and negligible sulphur at the surface.

At Loluai, at least three small iron lodes, none exceeding 10 feet in width, were examined. Accumulations of iron "float" suggest that additional small lodes occur in the same area. The predominant iron mineral is hematite, replacing magnetite. The principal lode contains an interesting copper carbonate enrichment on the footwall at its southern end. Early prospectors sank a 28 ft. shaft and cut a large costean through the copper showing. A collapsed portal indicates that they attempted to crosscut the lode. Copper carbonate is stacked in small dumps near the old workings. Chalcopyrite was seen as rare disseminations in nearby epidote rocks but not in the hematite lode. At the northern end of the Loluai mineralized area, a narrow pyritic shear, with malachite impregnations has been cut by a short adit.

The Norac and Loluai iron lodes are not impressive as iron ore prospects.

The copper showing on the main Loluai lode should be further investigated by opening up and extending an old adit to cross-cut the lode about 80 feet below the surface. Should such work indicate any significant increase of chalcopyrite the prospect would be greatly enhanced.

II. INTRODUCTION

(a) General

The examination and mapping of known iron - copper lodes on the Suloga Peninsula was carried out during August, 1956, at the request of Mr. R. C. Neate, long-term resident of Woodlark Island, and Mr. M. W. Darson, representing Derby and Company, London.

The investigation was restricted to known mineralization near the coast, west of Suloga Point.

(b) Access and Anchorages

Woodlark Island is an outlying island about 370 square miles in area situated approximately 170 miles north-east of Samarai at the eastern tip of the Papuan mainland.

The island is not on any major shipping routes but is visited at six-weekly intervals by small vessels from Samarai which collect copra and shell, the only exports. These vessels anchor in Kwaipan Bay near Kulumudau, where the Neate family, the only European residents on the island, are established.

Suloga Peninsula is the rugged headland which protrudes from the centre of the southern coastline of the island with Wonai Bay on the west and Suloga Harbour on the east.

The mineralization on Suloga Peninsula crops out within a few hundred feet of the coastline/at both at Norac and Loluai. Norac is about 1½ miles north-west of the most southerly tip of Suloga Point, and Loluai is situated along the coast two miles further to the north-west. Suloga Harbour could provide all-weather anchorage for large ships, and a suitable loading site to support a large mining operation could be located on the eastern shore of the harbour. This would require road haulage of two to four miles from the mineralized areas. Temporary loading facilities for a small operation could probably be established during the north-west monsoonal season on the open south coast at Norac or Loluai where there are 2 to 6 fathoms of water beyond a fringing reef which extends 200 to 300 feet offshore. A narrow and shallow passage and anchorage at Kwagai, about a mile west of Loluai, is suitable only for shallow draft vessels.

(c) Climate and Vegetation

Annual rainfall is approximately 180 inches, fairly evenly distributed throughout the year, with only a slight slackening during December and January. Thick rain forest covers most of the island except for areas previously cleared for mining operations and gardening.

(d) Population

The population of Woodlark Island probably does not exceed 1000 natives, most of whom are scattered around the coastline where fish are plentiful. These people derive a small income from the production of copra both from village plantations and plantations owned by the Neate family.

When the market is favourable they also engage in shell fishing, and produce mostly trochus. The local population is not regarded as a source of good labour; natives from the D'Entrecasteaux Islands are preferred, particularly for mining.

(e) Mapping

Outcrop mapping of the Norac and Loluai iron lodes and their immediate environs was carried out by telescopic alidade and stadia traverses, with some side-traversing by pace and compass. Outcrops are scarce and, in addition, both areas are heavily overgrown. Most of the formation or lode boundaries shown on the accompanying plans were inferred from the distribution of talus and magnetite - hematite "float". Only one reliable dip for the Norac mineralization was recorded; this was taken in an old costean in the main Norac lode.

Form lines at 10 feet intervals on the plans are an approximation based on heights determined at the alidade and stadia traverse stations.

III. HISTORY AND PREVIOUS INVESTIGATIONS.

Gold was discovered at Suloga in 1895. It is likely that the Norac and Loluai iron - copper lodes were found shortly after, when the area was first prospected, as the iron "float" from these deposits is prominent along the coastline.

A broad picture of the geology of Woodlark Island is provided by Evan R. Stanley (1912) whose report deals particularly with gold mining activities which were booming at the time of his visit. Stanley recorded magnetite and hematite deposits west of Suloga Point at Norac and Sililoi (probably the Loluai locality described in this report), and mentioned shallow workings on a micaceous hematite lode "on the saddle between Suloga Village and the Point". The latter occurrence was not located but it has since been indicated to Mr. Neate by local natives.

The collapsed shallow workings at Norac and Loluai have been attributed to *Messrs. Barton, Reynolds and Clancy who were prospecting the area in 1914. *Captain Osborne, then manager of the Dubuna Copper Mines near Port Moresby, is reported to have examined the area in 1916. This activity was presumably directed towards copper enrichments within the lodes. There is no recorded production from this area, but both at Norac and at Loluai small dumps of selected copper carbonate ore have been stacked. The Suloga prospects were abandoned during the general exodus of miners from Woodlark Island in the first World War.

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* Personal communication from R.C. Neate, full names not known.

Attention was drawn to the area by Mr. R. Neate in 1953 when five prospecting areas, each of one square mile, were taken up in the names of four members of the Neate family and Mr. R. Cox. These holdings were under option to Broken Hill Proprietary Ltd. for two years, but after examination by Messrs. F. Canavan and R. G. Collins in 1954 and an aerial magnetic survey in 1955, the option was relinquished.

IV. GENERAL GEOLOGY

The present investigation was restricted to the immediate environs of the known iron mineralization at Norac and Loluai and no regional work was attempted.

Evan R. Stanley (1912) investigated in detail the gold mining operations current at the time of his visit; and as a result of broad, rapid reconnaissance produced a geological sketch map of the island. Subsequent workers have been concerned only with individual mining prospects and Stanley's original map has not been revised.

Most of the island is covered by Pleistocene and Recent limestone elevated up to 200 feet above sea level. Low lying alluvium mostly swampy, is also widespread.

The older rocks, comprising Tertiary and older sediments, volcanic rocks, and both basic and acid intrusives, occupy about 50 square miles. They form hilly country along the south coast between Wonai Bay and Suloga Harbour and also in the Okiduse Range which extends north-easterly from Suloga for about ten miles to Mt. Kabat near the northern coastline. Stanley (1912) also showed several small inliers of these older rocks within the young alluvial and limestone cover.

Much of the area of older rocks is soil covered and outcrop mapping, particularly in the principal gold areas, does not provide much information. Gold mineralization is widespread and no specific host formation has been recognised. Stanley considered that the gold was introduced by "granite and porphyry". Reconnaissance observations at Kulumudau suggest that, there at least, mineralization is associated with andesitic volcanic rocks and it is suspected that some of the gold mineralization attributed by Stanley to the "granite and porphyry" may, in fact, have followed a Tertiary phase of vulcanism. The wide distribution of mineralization within the exposed older rocks implies that mineralization will extend under the cover of younger limestone. Thus, with an appreciation of the controls of this mineralization and the application of modern geophysical aids, known prospects might be extended, and new prospects sought, under the limestone cover.

Stanley's geological map (1912) shows granitic rock forming the core of the Okiduse Range and extending across Suloga Harbour to Wonai Bay. Several former gold producing areas are marginal to this igneous mass and undoubtedly genetically related to it. The so-called "sedimentary metamorphic" formation which Stanley shows flanking the main granitic body on the south and south-east was seen during this survey in the Norac and Loluai areas as dense, sometimes bedded, light-green to dark-grey rocks enclosing zones of garnet-epidote rock containing the magnetite - hematite lodes. This formation, understandably

described in the field by Stanley as "sedimentary metamorphic", is in the Norac and Loluai area a sequence of uralitized andesitic and basaltic tuffs and lavas, pale green and grey finely bedded silicified argillites, greywackes and garnet-epidote rocks probably derived by metasomatism from limestone. The silicified argillite was used by natives for the manufacture of spear and axe heads which were traded extensively in the eastern Papuan islands, being known widely as 'suloga'. An accumulation of argillite chips and broken axe-heads on the hill above the Norac lodes indicates the site of a former 'axe factory'. Coarse, unmetamorphosed basaltic agglomerate, seen on the coastline south of Norac, is probably unconformable on the uralitized volcanics, though it appears to have been included with them by Stanley.

Basic igneous rocks reported by Stanley as intruding the "sedimentary metamorphic" formation were not identified during this investigation but they may have been confused with the dark, basic uralitized volcanic rocks common near the Norac and Loluai mineralization.

Granodiorite was seen at the northern end of the Norac area in contact with mineralized garnet rock. Very fine gold was obtained in dish prospects from small creeks crossing this intrusive contact. Light coloured rocks mapped near Loluai as "feldspar porphyry" were later identified as hornblende-quartz-andesite (see Appendix I). However, as at Norac, intrusive granodiorite, although not seen, is probably responsible for the garnetization and iron - copper mineralization at Loluai.

Nasai Island, west of the Wanai - Suloga Peninsula, consists almost entirely of limestone, partially recrystallised, moderately dipping and probably unconformable on the uralitized volcanic formation. The Nasai Limestone may be of early Tertiary age; it is certainly older than the sub-horizontal raised limestones of the Woodlark mainland and it is probably younger than the limestone from which the skarn of the Norac and Loluai areas was derived.

The genetic and structural relationship of the Suloga iron lodes is still rather obscure as the investigation was directed particularly towards determining the order of magnitude of the known mineralized outcrops. Poor exposures and lack of time did not permit thorough mapping of the area around known lodes. However, a striking similarity is apparent between the geological environment of the Suloga iron - copper mineralization and that near Cape Lambert New Britain; where the deposits were drilled (Gardner 1957). At both localities, magnetite and hematite with some copper carbonate are associated with a uralitized basic volcanic sequence, interbedded with garnet rocks and near medium acid intrusions. Gardner (1957) has described garnet rock metasomatically replacing crystalline limestone near the iron lodes at Langinoa, Cape Lambert. Limestone was not seen in the immediate vicinity of the Suloga mineralization but the garnet - epidote rocks probably represent completely metasomatized limestones.

V. THE MINERALIZED AREAS.

(a) Norac.

Magnetite - hematite boulders are scattered over 1500 feet of coastline adjoining the Norac iron lodes. A prominent outcrop of garnet - epidote rock containing segregations of magnetite - hematite and superficial copper carbonate stains marks the southern limit of iron ore "float" on the beach. The wide distribution of iron "float" on the beach and on the adjoining hill slopes misleadingly suggests more extensive outcrops than indicated by mapping.

The predominant formation at Norac consists of very tough, dark grey, uralitized andesitic and basaltic tuff with bedded, fine-grained, greenish, indurated sediments. This formation was only rarely seen in outcrop but occurs as the principal component of landslip scree which has partly concealed the lodes. The attitudes and interrelationships of sediments and volcanics are not known. The zones of garnet rock, in which the magnetite - hematite mineralization occurs in sub-parallel bands, probably represent small limestone lenses in the formation, which have been metasomatized.

Six iron-rich bodies are indicated on Plate 2, of which only the two central bands are of significant width. These strike approximately north and dip west, towards the coast, at about 60°. The larger lode is about 50 ft. wide and the smaller 30 ft. wide. They are separated by about 40 ft. of garnet rock containing narrow magnetite - hematite bands suggesting selective replacement of beds within the original limestone. The northern ends of the two principal magnetite - hematite lodes are concealed by the toe of a landslip, and, at the southern end, they strike into the sea. The 50 ft.-wide lode can be traced along strike for about 500 ft. and it reaches a maximum height of 150 ft. above sea level. The 30 ft.-wide lode was traced for over 350 ft. and its highest point of outcrop is 70 ft. above sea level.

At the surface, the mineralization is essentially hematite replacing magnetite; some voids may represent leached sulphides. Green copper carbonate occupies fractures and voids in a few localized zones. These copper showings attracted the early prospectors who cut a deep costeans into the two main lodes where the copper content was obviously above average. They stacked selected lode material but there are no records of any ore being shipped. Dish prospects from rubble on the costean floors yielded traces of native copper, but no gold. At depth it is likely that magnetite would predominate over hematite and that the sulphide content will increase below the influence of surface leaching. There may be significant secondary copper enrichments but, if the westerly dip persists, these would be close to sea-level and difficult to mine.

No systematic sampling was possible at the time of the investigation. A few grab samples were taken from the heaped "ore" at the entrances to the two old costeans on the two principal iron lodes. The results of assays on these grab samples, which probably represent the better grade of ore hand picked by early prospectors, are shown :

GRAB SAMPLE FROM	%SiO_2	Fe	Cu	Mn	TiO_2	S	P_2O_5 *
1. 50ft. lode (no obvious copper minerals)	4.6	65.7	0.25	0.25	-	-	Trace
2. 50ft. lode (obvious copper carbonates)	6.6	55.2	4.3	0.06	-	-	Trace
3. 30ft. lode (obvious copper carbonates)	6.7	56.3	3.2	0.06	-	-	Trace

* Gold and Arsenic not determined.

Calculations from outcrop dimensions, assuming a factor of 9 cubic feet per ton, indicate a possible 281,000 tons of magnetite and hematite in the 50 ft.-wide lode and 43,000 tons in the 30 ft.-wide lode. These estimates have been based on the lode outcrop boundaries shown on Plate 2, which are, for the most part, inferred from the distribution of lode "float". The estimates include only that portion of the lodes above sea level. The lodes do not re-appear on strike beyond the landslip and it is assumed that a possible 100,000 tons of lode material above sea level may be concealed. Thus, about 420,000 tons of magnetite-hematite of possible commercial grade may be contained above sea level in the two main lodes.

Other lesser magnetite - hematite lenses indicated on Plate 2, in the Norac area would not contribute significantly to reserves as they all outcrop at low elevations and are probably no more than 15 ft. wide.

The magnetite which outcrops near the beach at the toe of the landslip may have slumped from one of the larger lodes above it.

The boundaries of the most northerly lens of mineralization in garnet rock adjoining the granodiorite were only inferred from distribution of iron "float". The size and distribution of this material indicate that the lode is very small.

(b) Loluai

The Loluai magnetite - hematite mineralization is on the lower slopes of hills adjoining the coastline about three miles north-west of Norac. This is believed to be the Sililoi area described by Stanley. The iron mineralization is similar in character, and probably in origin, to that at Norac. The lodes are within garnet-epidote rocks, presumably metasomatized limestones, in a sequence of fine silicified and indurated greywacke sediments interbedded with uralitized basic and andesitic volcanic rocks. Kaolinised "porphyry" mapped from poor exposures in the mineralized area and seen on the hanging wall of the main mineralization was accepted as the source of metasomatizing and mineralizing fluids, but subsequent identification of this rock, in thin section, as a

hornblende-quartz-andesite (Appendix I) casts some doubt on this origin.

Structure in the area is obscured by soil and scree cover. Silicified sediments on the coastline just east of the mineralized area dip in direction 340° at an angle of 15-20° but the variance in attitude and the discontinuity of mineralization indicates that the detailed structure is complex. The main mineralization, well exposed in a small open cut, strikes 340° and dips 70° east-north-east. A small pyrite vein and the skarn boundary in the northern part of the area mapped also strike slightly west of north. This trend may be structurally significant.

A 28 ft. shaft, a small open cut, a collapsed adit, several costeans, pits and small heaps of assorted ore are the results of early prospecting. Attention was directed particularly towards a copper carbonate enrichment on the footwall of a small magnetite - hematite lode which crops out near the 100 ft. contour on a steep hillside overlooking the sea. The early prospectors had traced this lode by costeaning and pitting for about 200 ft. along strike; its width rarely attains 15 ft. The outcrop of the lode terminates abruptly at its northern end against talus from indurated sediments. Only the southern end has obvious copper enrichment in the form of malachite, azurite and possibly tenorite, cuprite and native copper. These copper minerals are associated with veins of copper-coloured hematite which in the field was mistaken for cuprite. Powdery magnetite and hematite make up the remainder of the lode outcrop. Some disseminated chalcopyrite was seen in epidote rocks on a mullock dump near the collapsed portal of the old adit. Three small dumps, apparently representing "ore" sorted into "high copper" "obvious copper" and "no obvious copper" categories, was roughly grab-sampled. Assays of these samples gave the following results :-

SAMPLE FROM	SiO_2	Fe	Cu	Mn	TiO_2	S	P_2O_5.
"high copper" dump	5.0	55.8	12.3	0.05	less than 0.1	trace	trace
"obvious copper" dump	9.2	49.4	9.2	0.04	not detected	0.35	trace
"no copper" dump	4.5	62.5	0.67	0.12	not detected	trace	trace

Arsenic and gold not determined.

Although the sulphur content in the above assays is negligible, the sulphide content of the lode can be expected to increase at depth and secondarily enriched copper - iron sulphides may occur near the water table. The bottom of the old 28 ft. shaft was apparently still in the oxidised zone as no sign of pyrite or chalcopyrite was seen in the old ore dumps.

The only other copper mineralization seen on the Loluai field was an impregnation of malachite with limonite and pyrite at the face of a short adit on the right bank of the creek about 900 ft. from the old shaft on a bearing of 350°. The adit was driven to intersect a pyrite vein striking slightly west of north and dipping steeply to the east, in skarn. There is no field evidence of lateral connection between this vein and the southern cupriferous lode, but it occurs on the same strike line and has comparable strike and dip.

A creek traverse through the Loluai area, shown in Plate 3, crossed two definite outcrops of magnetite - hematite mineralization within coarse garnet rock and two concentrations of "iron float" suggesting concealed mineralized bands. The outcrop and "float" dimensions indicate that the lodes are probably not more than 10 ft. wide and thus are not likely to contribute significantly to iron ore reserves of the area.

The first blocks of magnetite - hematite found in the creek bed lie at the base of a small waterfall over coarse garnet rock within 200 ft. of the creek mouth; a small iron lode is probably concealed nearby. About 100 ft. further upstream magnetite - hematite outcrops in a 15 ft. waterfall, within coarse garnet rock. This lode shows distinct banding which, in the creek exposure, dips north at 30°. A diminishing trail of "float" from this lode was traced west then north-west, for 450 ft. A selected specimen taken at the waterfall outcrop was mainly hematite replacing magnetite, and contained a small amount of siderite; it assayed 74.3% Fe, 2.7% SiO_2, 0.25% Cu, 0.07% Mn, trace P_2O_5 and no titanium dioxide or sulphur. Debris from a landslip conceals bedrock for about 300 ft. north of the waterfall exposure. Above this, an accumulation of iron "float" suggests a small concealed magnetite - hematite lode. A further 150 ft. upstream another small lode containing some pyrite oxidising to limonite is exposed striking north-north-west and dipping steeply to the east. The pyrite in this exposure suggests possible correlation with the 1 ft. wide pyritic shear which outcrops on the right bank of the creek a further 250 ft. north. A short adit driven by early prospectors alongside the shear showed faint malachite stainings at the face.

A large area of garnet rock weathering to limonitic clay, with occasional clusters of iron "float" at the surface, was seen about half a mile north-west of the mapped area. The size and dimension of this "float" suggests that the body from which it is derived is not likely to be a commercial iron deposit but may be worthy of closer investigation as a copper prospect.

No estimate of magnetite - hematite in the Loluai area has been made because individual lodes are obviously too small for economic iron deposits.

VI. CONCLUSIONS AND RECOMMENDATIONS.

The iron - copper mineralization at Norac and Loluai is essentially hematite replacing magnetite with local copper carbonate enrichments. The host rock is invariably coarse garnet-epidote rock.

At Norac, the two main lodes may contain 420,000 tons of possible commercial grade magnetite - hematite above sea-level. Copper carbonates occur as fracture fillings in

localized sections of the lode, but they are nowhere sufficiently abundant to provide high-grade copper ore; in general, mining would produce ore averaging not more than 1% copper. The smaller iron lodes in the Norac area which, at outcrop, are too small for exploitation, are not included in the estimate given above.

At Loluai, all known iron lodes are too small to be considered as iron orebodies. The copper mineralization, which was worked by early prospectors, may provide sufficient high-grade oxidised copper ore (+ 10% Cu) to warrant re-opening the collapsed adit and extending it to about 180 ft. from the portal to crosscut the lode about 80 ft. below its outcrop. At this depth any sign of copper sulphide enrichment would warrant further exploration along the strike.

Samples taken during the investigation were not assayed for gold, but dish prospects taken from the old workings at both Norac and Loluai gave negative results.

VII. ACKNOWLEDGEMENT.

The hospitality of the Neate family is gratefully acknowledged. Mr. R. Neate's local knowledge and his assistance in the field, both personally, and in providing labour, greatly facilitated the investigation.

VIII. REFERENCES.

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GARDNER, D.E., 1957 - Iron ore deposits near Cape Lambert, New Britain. Bur. Min. Resour. Aust. Rec. 1957/76

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APPENDIX I

BRIEF PETROLOGICAL DESCRIPTION OF SPECIMENS FROM SULOGA PENINSULA, WOODLARK ISLAND, PAPUA

(Location of Specimens shown on Plates II and III)

by

J.K. Lovering

The following descriptions refer to specimens collected by J. E. Thompson during an investigation of iron deposits on Suloga Peninsula, Woodlark Island and are submitted for petrological identification and brief description.

The specimen numbers are not Bureau of Mineral Resources laboratory registration numbers. The specimen localities are shown on plans accompanying this report.

1. WN 7.
   The rock is black and fine-grained, and has a conchoidal fracture.

   It consists of grains of oligoclase, pyroxene and chlorite, pseudomorphs of pyroxene, pyrite and interstitial actinolitic fibres.

   The rock is a metamorphosed oligoclase andesite or oligoclase andesitic tuff.

2. WN 8.
   Hematite is the main constituent of this Specimen and is replacing magnetite. Malachite and siderite are present.

3. WN 9. (b)
   Anisotropic hematite is replacing magnetite; siderite and malachite are present.

4. WN 9.(c)
   Hematite is replacing magnetite in this specimen. Siderite and malachite are present.

5. WN 10.
   The handspecimen is pale green; it contains crystals of epidote and calcite.

   The rock mainly consists of zones greenish-yellow garnet which appears to have replaced augite, remnants of which are present. Chlorite is veining the pyroxene remnants; quartz veins cut the pyroxene. The pyroxene is also being replaced by epidote, associated with magnetite and pyrite. Veins cutting the garnet carry calcite, quartz, and epidote.

   This garnet rock is the result of metamorphism of pyroxenite (?).

6. WL 1.
The handspecimen is black and fine-grained.

The thin section reveals that the rock consists of brecciated fragments of andesite in a darker-coloured groundmass of andesite.

The fragments are made up of laths of oligoclase and interstitial actinolite and magnetite.

The darker-coloured andesite contains fine-grained fragments of quartz, and oligoclase in a groundmass of crypto crystalline material with accessory hematite.

7. WL 2.
The hand specimen is a grey weathered rock.

The thin section reveals a metasomatised epidote, grains of anisotropic garnet, clay minerals and feldspar grains.

The rock is extensively metasomatised.

8. WL 3.
Hematite comprises most of this specimen; remnants of pyrite are present.

9. WL 4.
Hematite is the main constituent of this specimen. Malachite is present.

10. WL 5.
The specimen consists mainly of magnetite traced with small veins of hematite. Patches of green malachite occur through the rock.

11. WL 6.
The handspecimen is grey and fine-grained.

The texture of the rock is tuffaceous. Grains of uralitised ferromagnesian minerals, felspar, and sphene, and hematite, constitute the rock.

The uralite, actinolitic amphibole, replaced pyroxene, remnants of which are present.

The rock is tuff derived from basic volcanics.

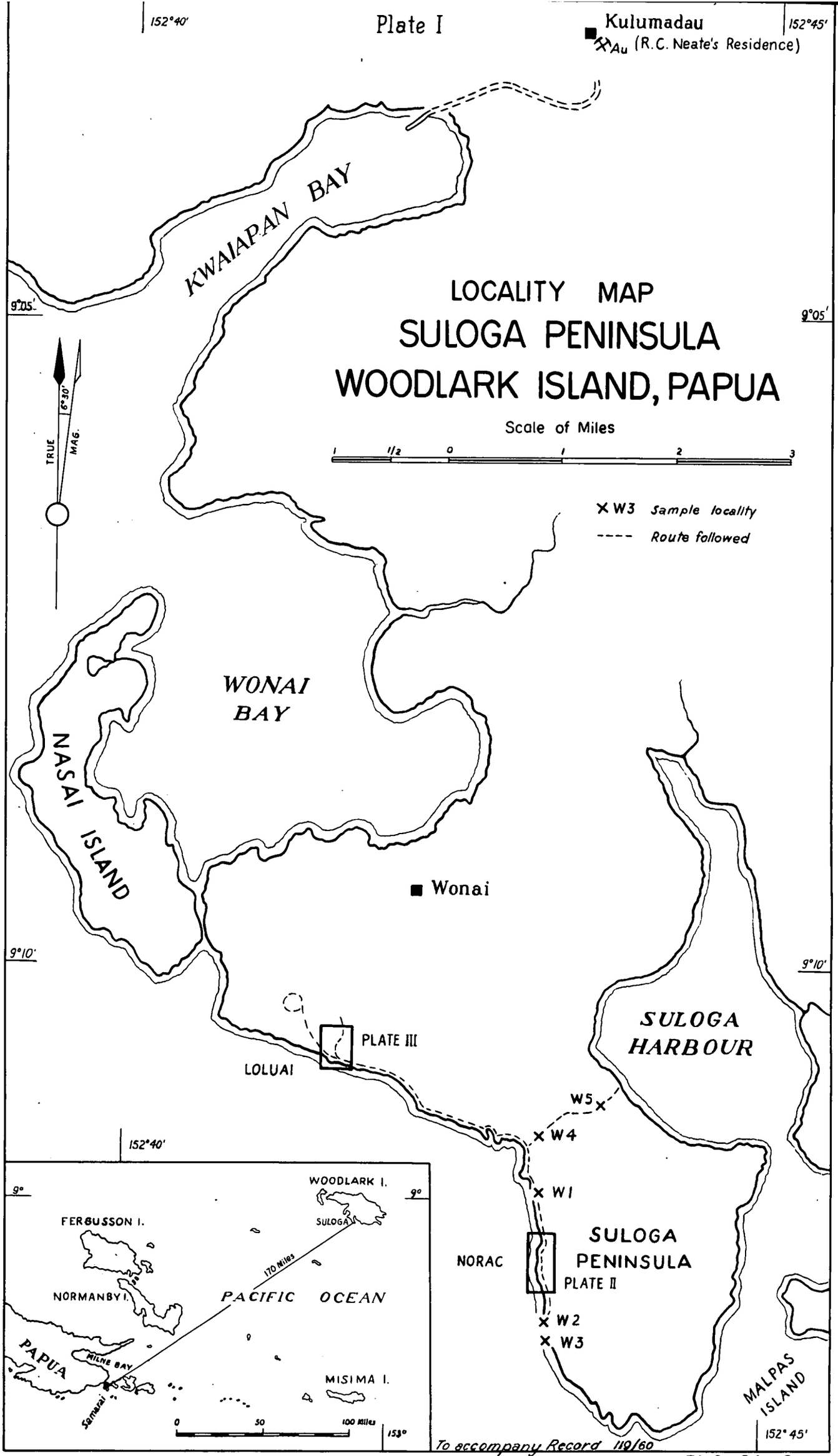
12. WL 7.
The handspecimen is a light coloured prophyritic volcanic.

The thin section reveals fluidal movement of the phenocrysts of feldspar, and hornblende and accessory magnetite in a groundmass of granular quartz, feldspathic material and fine grains of hornblende.

The phenocrysts are labradorite and have a rim of oligoclase.

The rock is hornblende-quartz andesite.

Plate I



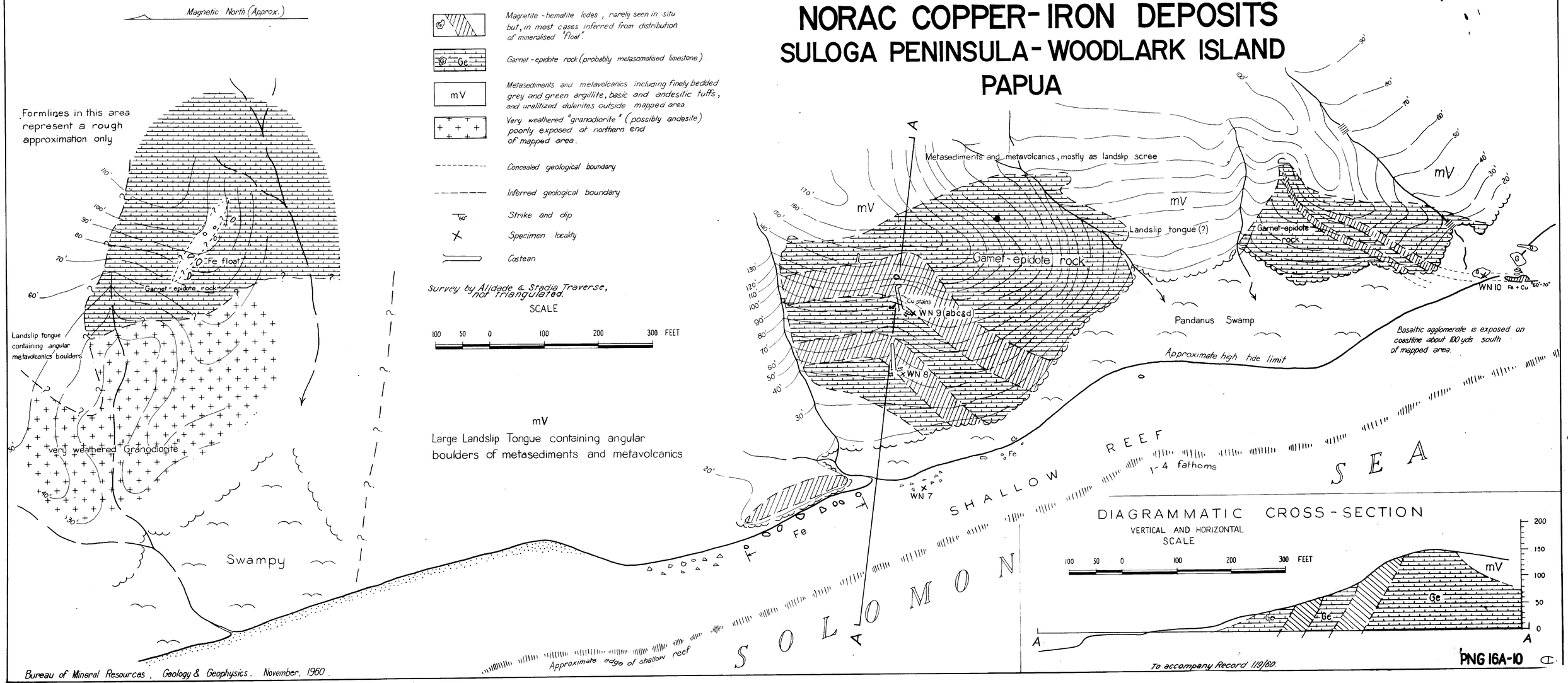
To accompany Record 119/60

Bureau of Mineral Resources Geology and Geophysics Nov. 1960

PNG 16A - 9

A.M.

GEOLOGICAL SKETCH MAP
NORAC COPPER-IRON DEPOSITS
SULOGA PENINSULA - WOODLARK ISLAND
PAPUA



Bureau of Mineral Resources, Geology & Geophysics. November, 1960.

To accompany Record 119/60.

PNG 16A-10

LOLUAI COPPER-IRON PROSPECT

WOODLARK ISLAND

PAPUA

100 0 100 200 Feet

Survey by Alidade and Stadia Traverse — Not triangulated, topography approximate

Garnet rock extends westwards for at least 1000 ft. with clusters of Fe float

Malachite staining with limonite and pyrite

1 ft wide pyrite

Ge

Garnet rock (deeply weathered)

Basic tuff

mV

10 ft waterfall

Concentration of Fe float

Large boulders of basic tuff (possible landslip debris)

Hornblende-quartz andesite (deeply weathered)

Trail of Fe float

Basic tuff boulders

15 ft waterfall

Fe

28 ft shaft

Fe + Cu

Garnet-epidote rock

Shallow Costean

Concentration of Fe float

Andesitic tuff

Fe float

Coastline not surveyed — approximate only

Sand & weed bottom

Metasediments ?

Bedded meta-sediments

15°-20°

Shallow & narrow passage 3ft. at low tide

Mostly dead coral, exposed at low tide

Approximate edge of reef

Surf breaks on reef during S.E. season

Magn. North (approx.)

Reference

~	*Alluvium*
Cu	*Copper mineralisation*
Fe	*Magnetite - hematite lode, usually inferred from float distribution.*
G Ge	*Garnet - epidote rock, probably metasomatised limestone.*
mV	*Metavolcanics and metasediments including basic and andesitic tuffs and lavas, siliceous sediments and greywacke.*
55°	*Dip and strike*
?——?	*Inferred geological boundary*
WL7 ×	*Specimen locality*
	Costean
120′	*Form lines (approx.)*
	Edge of hills
	Ore dump
	Shaft

PNG 16A-11

Bureau of Mineral Resources, Geology and Geophysics, November, 1960.

To accompany Record 119/60

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