

**MINERALOGICAL REPORT No. 8937**  
*by Alan C. Purvis, PhD.*

October 16th, 2006

**TO :** Mr John Benger  
Project Manager  
Goldstake Exploration Inc.  
PO Box 42925  
CASUARINA NT 0811

**YOUR REFERENCE :** Email from Wilson Gewargis, 8/9/06

**MATERIAL :** Drill Core samples, Home of Bullion Property,  
NT

**IDENTIFICATION :** Drill hole numbers HOB06-6, #1, 2, 3, 4, 5, 6, 7,  
9, 12, 14, 15

**WORK REQUESTED :** Section preparation, description and petrological  
report.

**SAMPLES & SECTIONS :** To be returned to your Casuarina address at a  
later date.

**DIGITAL COPY :** E-mailed 16/10/06  
<johnbenger@optusnet.com.au>.

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## SUMMARY COMMENTS

The nineteen core samples described in this report from 16 normal thin sections and 3 polished thin sections are from eleven drillholes in the Home of Bullion Mine area near Barrow Creek in the Northern Territory. Their essential petrographic characteristics are summarised in Table 1 below. This report follows an earlier report No. 8933 (3/10/06), also to John Benger, on 19 rock samples from a costean believed to be at surface above the area drill by these eleven drill holes.

*The 16 samples examined as thin sections* are mostly metamorphosed fine-grained sediments (shale to medium-grained sandstone), essentially quartz-muscovite-biotite schists, some with fine garnet. The biotite has been altered to chlorite, with chlorite and/or biotite rimming garnet. Many samples have post tectonic chlorite, partly coarse platy, also as chlorite replacing biotite. Other samples contain sericitised probable andalusite porphyroblasts, and several have altered feldspar, now sericite  $\pm$  hematite  $\pm$  albite. Quartz veins and less abundant adularia veins occur locally and some samples examined in thin section contain accessory sulphide (pyrite > chalcopyrite?).

A planar schistosity is common throughout, variably layer-parallel or oblique to layering. Other samples have crenulation cleavages and one has folds with the first schistosity ( $S_1$ ) as axial plane, folded about the crenulation cleavage ( $S_2$ ). Metamorphism is interpreted to have been of low amphibolite facies as the assemblage biotite-andalusite suggests 500-600°C at pressures of less than 400MPa.

*The three polished thin sections* were selectively cut from sulphide  $\pm$  magnetite-rich lithologies (see Table 1):

1. HOB06-2, 115.6m: this sample has two chalcopyrite-rich domains separated by a sphalerite-rich zone. The chalcopyrite has inclusions of Fe-rich sphalerite that have been veined by chalcopyrite  $\pm$  chalcocite and the chalcopyrite is partly rimmed and veined by chalcocite. Minor partly low-temperature pyrite is present, locally lamellar. The sphalerite-rich domain has less Fe-rich sphalerite enclosing chalcopyrite, chalcocite and mostly granular pyrite. The gangue includes quartz and phlogopite as well as early retrograde chlorite and later retrograde or supergene smectite and carbonate.

2. HOB06-3, 97.9m: This is a complex, layered lithology with a band rich in chlorite and muscovite that also contains sulphides, magnetite, garnet and rare gahnite, passing into a zone of coarse-grained pyrite with magnetite and other sulphides as well as chlorite and smectite. Magnetite is abundant in a zone with epidote and smectite as well as minor sulphide and this passes into a zone with magnetite largely cemented by sphalerite and then into a second layer rich in pyrite. Granular pyrite and magnetite seem to be early, together with muscovite and epidote, and have been veined and rimmed by chalcopyrite and sphalerite. Chlorite may have been later, with retrograde or supergene smectite apparently replacing prismatic crystals that may have been amphibole or pyroxene, in equilibrium with epidote but not with muscovite. Lamellar and microporous pyrite  $\pm$  marcasite and granular marcasite also seem to be of low-temperature hydrothermal or supergene origin. Trace molybdenite was also seen in this sample.
3. HOB06-9, 163.0m: this sample has lamellae variously rich in pyrite and magnetite with chalcopyrite interstitial to and veining pyrite and as separate inclusion-rich patches. The gangue is mostly smectite  $\pm$  chlorite with minor carbonate. Some of the pyrite is studded with marcasite inclusions but there may also be primary pyrite.

These sulphides may represent modified sedimentary/syngenetic mineralisation, but an epigenetic origin may also be interpreted on the basis that the gangue does not seem to represent normal metasediment as seen in the same drillholes.

In the summary Table 1 below, semiquantitative abundances are shown as vm= very minor, m = minor, C = common, A = abundant; M = Major and D = dominant.

**Table 1: Characteristics of samples, Report No, 8937**

Hole and depth		Quartz	Muscovite	Biotite	Chlorite	Sericite		Notes	
HOB06-1	86	A	m	C	m	m	Planar schistosity	Schistose chlorite	
HOB06-1	91.2	D	A		m	C	Planar schistosity	Altered andalusite and chlorite ex-biotite	Slightly rotated porphyroblasts
HOB06-2	79.3	A	A	C	m		Crenulated schistosity; quartz-rich lenses	Post-tectonic chlorite	Magnetite porphyroblasts
HOB06-2	115.6	vm			vm	m	Chalcopyrite > sphalerite	Foliated chlorite	Quartz, clay and carbonate
HOB06-3	37.6	A	A	vm	C		Crenulated schistosity; quartz-rich lenses	Chlorite ex-biotite	Post-tectonic chlorite
HOB06-3	97.9	vm	m		m-C		Pyrite > sphalerite > chalcopyrite	Chlorite enclosing muscovite; smectite and carbonate	Epidote in sulphide, rare garnet and gahnite
HOB06-4	100.2	A	A		m-C		Crenulated schistosity ; microshears	Chlorite ex-biotite	Post-tectonic chlorite
HOB06-5	14.7	D	C	m	m		Schistosity oblique to layering	Post-tectonic chlorite	Metasandstone?
		A	A	m	m-C		Graded: quartz-rich to muscovite-rich		
HOB06-6	46.6	m	D	m	m-C		Crenulated schistosity, quartz-poor	Post-tectonic chlorite	Disseminated oxide
HOB06-6	96.5	M	C	m	m	m	Sericite-albite ex-feldspar	Oxide, apatite and zircon	Metasandstone?
HOB06-7	27.4	M	A	C	vm		Schistosity oblique to layering	Post-tectonic chlorite	Disseminated oxide
HOB06-7	52.3	A	C-A	vm	vm		Schistosity oblique to layering	Fine-grained chlorite	Crosscutting quartz veins
HOB06-7	82.6	m	M	C	m		Crenulated schistosity, quartz-poor	Layer-parallel quartz-muscovite veins	Magnetite porphyroblasts
								Biotite-chlorite-quartz aggregates	
HOB06-7	131.8	m	D	m	m-C		Crenulated schistosity, quartz-poor	Post-tectonic chlorite	

Hole and depth		Quartz	Muscovite	Biotite	Chlorite	Sericite		Notes	
HOB06-9	54.6	A	A		C	M	Contorted schistosity; large quartz veins; altered andalusite	Sericite-albite ex-feldspar	Slightly rotated porphyroblasts
								Altered andalusite and chlorite ex-biotite	
HOB06-9	163						Laminated pyrite-magnetite-chalcopyrite	Smectite and carbonate gangue	
HOB06-12	84.5	A	D	m	m		Crenulated schistosity axial plane to folds	Post tectonic chlorite	
							Sericite-rich bands and quartz layers/veins		
HOB06-14	31.8	D	m	m			Planar schistosity	Rare garnet: apatite and zircon	Metasandstone?
HOB06-15	36.3	A	M	m	m		Schistosity oblique to layering	Quartz-rich to biotite-rich; rare chlorite	Pyrite with chlorite and adularia

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**INDIVIDUAL DESCRIPTIONS [LISTED IN ORDER OF INCREASING  
DRILL HOLE NUMBER AND DEPTH]**

**HOB06-1, 86m                      Quartz-biotite-muscovite schist with post-tectonic chlorite,  
authigenic tourmaline, sparse leucoxene and rare apatite.  
Interpreted as metasiltstone?**

Mineral	Abundance	Character
Quartz ( $\pm$ feldspar?)	Major	Recrystallised
Biotite	Common	Schistose
Muscovite	Minor	Schistose
Chlorite	Minor	Post-tectonic
Tourmaline	Accessory	Authigenic/metamorphic
Leucoxene, apatite	Accessory	Detrital

This is a relatively homogeneous metasediment with schistose biotite and muscovite but mostly post tectonic chlorite as crystals to 2.5mm long. The quartz (and rare possible feldspar that has been weakly clouded by sericite) define a micromosaic to 0.3mm in grain size. Accessory tourmaline occurs as prisms to 0.3mm long and may be authigenic, but fine-grained opaque oxide has been altered to leucoxene and rare apatite is present. Very small radioactive grains have pleochroic haloes in biotite and chlorite and suggest metasiltstone.

**HOB06-1, 91.2m**      **Altered probable quartz-muscovite-biotite-andalusite schist with chlorite ex-biotite and as post tectonic crystals, also sericite derived from probable andalusite: metasiltstone.**

Mineral	Abundance	Character
Quartz	Dominant	Recrystallised
Sericite	Abundant	Ex-andalusite
Muscovite	Common	Schistose
Chlorite-1	Minor	Ex-biotite (schistose)
Chlorite-2	Very minor	Post-tectonic
Leucoxene	Accessory	Ex-opaque oxide

This sample has sericitised probable andalusite porphyroblasts to 8mm long set in altered quartz-muscovite-biotite schist with totally chloritised biotite and less abundant crosscutting chlorite of post-tectonic origin. Slight asymmetry in schistosity-porphyroblast relations and weak internal schistositities in the altered porphyroblasts suggests rotation of the porphyroblasts. Very small opaque oxide grains have been altered to leucoxene and microcrystalline radioactive grains have pleochroic haloes in chlorite, suggesting metasiltstone.

**HOB06-2, 79.3m**

**Layered quartz-muscovite-biotite schist (metasiltstone) with sparse post-tectonic chlorite and porphyroblasts of magnetite. Sparse crosscutting quartz veins occur.**

Mineral	Abundance	Character
Quartz	Abundant	Recrystallised
Muscovite	Abundant	Schistose
Biotite	Common	Schistose
Chlorite	Very minor	Post tectonic
Magnetite	Accessory	Metamorphic

This sample has lamellae from 1mm to 8mm wide variously rich in quartz, muscovite and biotite. The quartz-rich lamellae have a planar layer-parallel schistosity but the more mica-rich lamellae have a crenulation cleavage at 40° to the layering and first schistosity. There are rare narrow quartz veins at a low angle to the crenulation cleavage and sparse small porphyroblasts of magnetite veined by chlorite. Sparse fine-grained post tectonic chlorite is disseminated. This seems to represent metasiltstone.



HOB06-2, 115.6m

Massive chalcopyrite > sphalerite> chalcocite with pyrite, quartz, chlorite, phlogopite and clays; cut by carbonate veins.

Mineral	Abundance	Character
Chalcopyrite	Dominant	Massive sulphide
Sphalerite (Fe-rich)	Common	Part of massive sulphide
Chalcocite	Minor	Rimming chalcopyrite
Pyrite	Very minor	In sulphide and clay Disseminated through sulphide
Quartz	Very minor	
Phlogopite	Rare	
Chlorite	Very minor	
Clay (smectite ± sericite?)	Very minor	In patches in sulphide
Carbonate	Very minor	In fractures

This sample is essentially heterogeneous massive sulphide with two zones largely composed of chalcopyrite and possibly vein-like masses of moderately iron-rich sphalerite. **The main chalcopyrite** has sparse inclusions of darker, more iron-rich sphalerite and partly low-temperature pyrite, with pyrite and chalcopyrite as fine-grained or microcrystalline inclusions in sphalerite. Some of the chalcopyrite has been veined and rimmed by chalcocite and chalcocite accompanies chalcopyrite and low-temperature pyrite in the sphalerite. Chalcopyrite and chalcocite also occur in fractures in sphalerite. Chalcocite locally rims and veins chalcopyrite and there are patches of lamellae pyrite ± marcasite interlaminated with chalcopyrite and/or chalcocite.

**The sphalerite-rich** zone has less iron-rich sphalerite than that enclosed in chalcopyrite but this material seems to be fine-grained with abundant interstitial chalcopyrite and chalcocite as well as granular, porous and lamellar pyrite ± marcasite. Both of these zones contain lenses of carbonate enclosing microcrystalline possible hematite or goethite.

The smaller chalcopyrite zone seems to have more abundant chalcocite as separate patches enclosing very minor chalcopyrite and as rims and in fractures in chalcopyrite. Sphalerite and lamellar pyrite occur in the chalcopyrite in this zone.

Schistose chlorite is enclosed in the sulphide as well as patches of quartz to 4mm long and rare pale phlogopite. Areas with interstitial smectite  $\pm$  sericite enclose partly kinked chlorite as well as relatively pale sphalerite and mostly granular pyrite. Sparse fractures occur filled with carbonate.

**HOB06-3, 37.6m**

**Banded and partly crenulated quartz-muscovite-biotite schist with minor chlorite and rare limonite after pyrite: metamorphosed sandstone/siltstone and shale.**

Mineral	Abundance	Character
Muscovite	Major	Schistose/crenulated
Quartz	Abundant	Recrystallised
Chlorite	Minor	Schistose/crenulated
Biotite	Very minor	Mostly post tectonic
Leucoxene, rutile	Accessory	Detrital
Limonite	Trace	Mostly ex-pyrite?

Partly lenticular millimetre to centimetre-scale compositional layering is seen in this thin section, with quartz-rich layers and lenses and mostly muscovite-rich bands. The quartz-rich layers have a layer-parallel schistosity, largely defined by muscovite, but the more micaceous lamellae have a crenulation cleavage at 70-85° to the layering, most intense in the most muscovite-rich lamellae. Minor biotite occurs in quartz-rich lamellae and in micaceous lamellae and is mostly schistose, whereas chlorite is partly schistose (partly ex-biotite) and partly post tectonic. Minor leucoxene and rutile are disseminated as well as small patches of limonite that may have formed from pyrite. This seems to represent interlayered shale and sandstone or siltstone.

**HOB06-3, 97.9m**

**Layered pyrite-magnetite-chalcopyrite-sphalerite-rich rock with chlorite, muscovite, epidote, garnet, gahnite, smectite and carbonate and rare hematite/goethite in different layers and lenses: also contains chalcocite, marcasite and trace molybdenite.**

Mineral	Abundance	Character
Pyrite	Major	Layered, granular
Magnetite	Common	In sulphide-poor layers
Sphalerite	Minor	Mostly in pyrite masses
Chalcopyrite	Very minor	Mostly in fractures
Smectite	Minor	Interstitial
Chlorite	Minor	Layered and interstitial
Muscovite	Very minor	Mostly decussate
Carbonate	Very minor	Interstitial
Epidote	Minor	Interstitial to sulphide
Garnet	Very minor	In chlorite
Gahnite	Rare	In garnet

Bands to 30mm wide are present in this thin section with pyrite as the main mineral in the thickest layer and layers or lenses variously rich in magnetite, sphalerite, chlorite, muscovite, epidote and smectite. The zones are as follows.

1. At one end of the thin section, adjacent to the main pyrite-rich band, there are bands rich in schistose or decussate coarse-grained chlorite enclosing lenses and crystals of largely decussate muscovite. Lamellae of chalcocite and sphalerite occur in the chlorite, with less abundant chalcopyrite and rare magnetite. Some of the chalcocite occurs as rims on chalcopyrite. There is also rare molybdenite 0.1mm in grainsize in chlorite and magnetite grains to 1mm, veined by chalcopyrite and/or sphalerite. Patches of coarse-grained pyrite occur, rimmed and veined by chalcopyrite, which is in turn rimmed and to a lesser extent veined by sphalerite. This area also contains minor garnet, to 3mm in grainsize, enclosing pale green gahnite and cut by sulphide-filled fractures, mostly chalcopyrite and/or sphalerite, but also cut by smectite-filled

fractures. Magnetite adjacent to the garnet has been cemented by sphalerite with minor to abundant chalcopyrite  $\pm$  chalcocite.

2. This passes into a zone rich in very coarse-grained pyrite and less abundant granular magnetite. Smaller and larger interstitial areas contain sphalerite, chalcopyrite and chalcocite, with chalcopyrite  $\pm$  chalcocite  $\pm$  sphalerite in fractures in pyrite and magnetite. Sparse chlorite is also enclosed in pyrite and magnetite-rich bands.
3. There is a magnetite-rich zone with carbonate, smectite and a large epidote-rich lens in the centre of the thin section, in a lens to 15mm wide. Some of the magnetite has been cemented by sphalerite and there is also relatively common chalcopyrite locally enclosing lamellar pyrite-marcasite or granular marcasite  $\pm$  carbonate. Areas rich in brownish smectite also occur, on either side of the main epidote-rich lens, with abundant fine granular magnetite or in pyrite-rich bands.
4. A band with less abundant smectite has granular magnetite cemented by abundant sphalerite, with less abundant chalcopyrite commonly enclosing lamellar low-temperature pyrite and/or marcasite.
5. A pyrite-rich band at the other end of the thin section to the chlorite-rich lamellae has interstitial smectite and carbonate. Sphalerite is mostly interstitial to pyrite with chalcopyrite largely in fractures and along grain boundaries in the pyrite-rich areas.

**HOB06-4, 100.2m**

**Layered and crenulated quartz-muscovite-chlorite schist with chlorite ex-biotite and partly post tectonic, rare garnet and accessory opaque oxide and leucoxene: metasiltstone.**

Mineral	Abundance	Character
Quartz	Abundant	Recrystallised
Muscovite	Abundant	Schistose, crenulated
Chlorite-1	Minor	Schistose, ex-biotite
Chlorite-2	Very minor	Post tectonic
Garnet	Trace	Peak metamorphic?
Oxide, leucoxene	Accessory	Detrital?

This sample has irregular layering, partly lenticular, with quartz-rich layers and lenses in a more micaceous host. The main schistosity is at about 30° to the layering, with a crenulation cleavage at a high angle to the first schistosity, mostly in more micaceous layers. The schistosity is mostly defined by muscovite with minor chlorite ex-biotite and rare fine-grained garnet that does not seem to have an internal schistosity. Minor post tectonic chlorite occurs as flakes to 1mm long, with chlorite also in microshears at a low angle to the crenulation cleavage. There is disseminated fine-grained opaque oxide and leucoxene. Very small radioactive grains occur in chlorite and this suggests metasiltstone.

**HOB06-5, 14.7m**

**Layered quartz-muscovite-biotite-chlorite schist with rare garnet and tourmaline: graded metasandstone-metapelite and cross bedded metasandstone.**

Mineral	Abundance	Character
Quartz	Abundant	Recrystallised
Muscovite	Abundant	Schistose
Biotite	Minor	Schistose
Chlorite	Minor	Mostly post tectonic
Garnet	Rare	Fine-grained
Albite-hematite $\pm$ sericite	Minor	Very fine-grained
Tourmaline	Rare	Partly detrital

This sample seems to have a graded bed passing up into a cross-bedded metasandstone. The graded bed passes upwards from quartz-rich into muscovite-rich (sandstone to shale) with the schistosity at 25° to bedding laminations, whereas the cross bedding is at as much as 55° to the schistosity and defined by very narrow micaceous lamellae, rarely containing garnet. Reddish, hematite-stained microcrystalline probable feldspar is most abundant in more micaceous parts of the graded unit, with tourmaline mostly in the cross bedded layer. Post tectonic chlorite, to 3mm in grainsize, is mostly in the graded layer, with rare small nodules rich in quartz and chlorite. Post tectonic chlorite also occurs in micaceous lamellae defining cross bedding, however.

**HOB06-6, 46.6m**

**Muscovite-quartz-biotite schist, strongly crenulated, with post tectonic chlorite and oxidised opaque oxide.**

Mineral	Abundance	Character
Muscovite	Dominant	Schistose. Crenulated
Quartz	Minor	Recrystallised
Biotite	Very minor	Schistose
Chlorite	Minor	Post tectonic
Hematite-stained possible feldspar	Very minor	Recrystallised
Oxide, oxidised	Accessory	Metamorphic

This sample is strongly crenulated with muscovite > quartz > biotite defining the schistosity and crenulation cleavage. Chlorite occurs as post tectonic crystals to 3mm long, partly parallel to the crenulation cleavage, with pleochroic haloes around microcrystalline radioactive grains. Very small grains have been stained by earthy hematite and microcrystalline opaque oxide may also have been altered to hematite. This is composed of metapelite.



**HOB06-6, 95.5m**

**Laminated quartz-biotite-muscovite-chlorite schist with altered feldspar, opaque oxide and adularia-filled fractures: metamorphosed fine-grained sandstone and siltstone.**

Mineral	Vol %	Character
Quartz	Dominant	Recrystallised
Biotite	Common	Schistose
Muscovite	Minor	Schistose
Chlorite	Minor	Schistose
Sericite-albite-hematite	Very minor	Ex-plagioclase
Oxide, apatite and zircon	Accessory	Fine-grained
Adularia	Very minor	In veins

This sample is weakly laminated with sparse biotite-muscovite-chlorite-rich lamellae and more quartz-rich bands. The schistosity is planar and parallel to the layering with a quartz-rich micromosaic to 0.3mm in grain size, fine-grained schistose phyllosilicates, sparse disseminated opaque oxide and reddish altered feldspar. Very minor apatite is disseminated as well as rare zircon. Rare post-tectonic chlorite occurs in a micaceous band. Narrow crosscutting fractures contain adularia.

This sample seems to be very fine-grained metasandstone with siltstone lamellae.

**HOB06-7, 27.4m**

**Fine-grained quartz-muscovite-biotite schist with chlorite, garnet, opaque oxide and rare tourmaline: metasandstone or metasiltstone.**

Mineral	Abundance	Character
Quartz	Major	Recrystallised
Muscovite	Abundant	Schistose
Biotite	Common	Schistose
Chlorite	Minor	Post tectonic
Garnet	Rare	Small grains (early?)
Albite-sericite $\pm$ hematite	Sparse	Ex-feldspar
Oxide, tourmaline	Very minor	Recrystallised

This sample is mostly fine-grained quartz-muscovite-biotite schist with a planar schistosity, but there are rare, narrow and impersistent biotite-rich lamellae at about 50-60° to the schistosity and small lenses of partly decussate biotite, accompanied by post tectonic chlorite, to 2mm long and sericite  $\pm$  hematite-clouded possible albite. Separate crystals of post tectonic chlorite occur and sparse flakes of chlorite or biotite occur adjacent to small grains of garnet to 0.4mm in diameter. Rare quartz-rich nodules occur to 1mm in diameter. Fine-grained opaque oxide is disseminated and is relatively abundant, with rare fine-grained tourmaline. This may represent metasiltstone or metasandstone.

**HOB06-7, 52.3m**

**Weakly layered quartz-muscovite-biotite-chlorite schist  
with sulphide in a quartz vein.**

Mineral	Abundance	Character
Quartz	Dominant	Recrystallised  Weakly schistose
Muscovite	Common	
Biotite	Common	
Chlorite	Minor	
Oxide	Accessory	Recrystallised
Quartz	Minor	In veins
Sulphide (pyrite > chalcopyrite?)	Rare	

This sample has a weak schistosity and diffuse compositional layering with the schistosity at about 45 ° to the layering. Most of the layers are quartz-rich with less abundant muscovite, biotite and chlorite in different proportions in different layers. Rare micaceous lamellae are partly rich in biotite, and fine-grained opaque oxide is disseminated. A lenticular quartz vein occurs at a high angle to the schistosity and also oblique to the layering. The quartz vein contains rare sulphide, possibly pyrite and chalcopyrite. There are also crosscutting narrow quartz veins and rare lenses of adularia and clay. This sample may represent fine-grained metasandstone or metasilstone.

**HOB06-7, 82.6m**

**Crenulated muscovite-quartz-biotite-magnetite schist with chlorite-biotite patches: cut by quartz-muscovite and biotite-chlorite veins, parallel to the crenulation cleavage, carrying sulphide (pyrite > chalcopyrite): metapelite.**

Mineral	Abundance	Character
Muscovite	Dominant	Schistose/in veins
Quartz	Common	Recrystallised/in veins
Biotite	Common	Schistose/post tectonic
Chlorite	Minor	Post tectonic
Magnetite	Very minor	Small porphyroblasts
Sulphide (pyrite > chalcopyrite?)	Very minor	In veins

This sample is composed of weakly to strongly crenulated muscovite and biotite with minor quartz, but has millimetre to centimetre-scale patches composed of decussate chlorite and biotite with granular quartz and rare magnetite. Parallel veins include several quartz-rich veins with muscovite and minor sulphide (pyrite > chalcopyrite?) as well as fewer chlorite-biotite veins with less abundant sulphide (chalcopyrite  $\pm$  pyrite?). Magnetite crystals to 1mm in diameter occur in the schist and in mostly quartz-rich veins and have been veined and replaced by Fe-rich chlorite.

This sample is altered and veined metapelite.

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**HOB06-7, 131.8m                      Crenulated quartz-poor quartz-muscovite-biotite schist  
with post tectonic chlorite: metapelite.**

Mineral	Abundance	Character
Muscovite	Dominant	Crenulated
Quartz	Minor	Recrystallised
Biotite	Minor	Crenulated
Chlorite	Minor	Post tectonic
Magnetite	Rare	Fine-grained

This sample is weakly to strongly crenulated and largely composed of quartz-poor quartz-muscovite-biotite schist with post-tectonic chlorite to 2mm in grainsize, rarely accompanied by biotite. The chlorite is mostly at a low angle to the crenulation cleavage with pleochroic haloes in chlorite and biotite indicating microcrystalline radioactive grains. Poorly defined quartz-rich and biotite-rich lenses and lamellae are roughly parallel to the original schistosity. Very minor opaque oxide is disseminated. This sample represents metapelite.

**HOB06-9, 54.6m**

**Quartz-chlorite-muscovite schist with sericitised probable andalusite porphyroblasts, cut by abundant quartz veins with very minor sulphide (pyrite > chalcopryite?)**

Mineral	Abundance	Character
Quartz	Major	In veins and recrystallised
Sericite	Major	Ex-porphyroblasts
Chlorite	Common	Ex-biotite; schistose
Muscovite	Common	Schistose
Sericite-hematite	Very minor	Ex-feldspar
Sulphide	Accessory	In veins
Adularia	Very minor	Late fractures

This sample has large lenses or fragments of relatively coarse-grained quartz-chlorite-muscovite schist with large and small areas of vein-quartz locally containing sericite-hematite-altered possible feldspar as well as chloritised biotite and muscovite. Similarly altered feldspar ( $\pm$  albite) occurs in some lenses of quartz-chlorite-muscovite schist with partly decussate muscovite. Along one side of the thin section the rock is largely altered schist without the obvious vein-quartz seen in the rest of the thin section. Totally sericitised probable andalusite porphyroblasts, possibly as much as 20mm in diameter, occur in the schist and vary from rounded to euhedral. The quartz veins are granular and contain very minor sulphide, possibly pyrite  $\pm$  chalcopryite. Late fractures are filled with fine-grained adularia and are widest in the schist, but narrower in vein-quartz and in altered porphyroblasts.

**HOB06-9, 163.0m**

**Laminated pyrite-magnetite-chalcopyrite with smectite and carbonate.**

Mineral	Abundance	Character
Pyrite ± marcasite	Abundant	Primary and secondary
Magnetite	Abundant	Granular, metamorphic
Chalcopyrite	Common	Granular and interstitial
Smectite ± chlorite	Common	Ex-metamorphic minerals
Carbonate	Very minor	Secondary

This sample is an irregularly laminated mass of pyrite, magnetite and chalcopyrite with interstitial smectite ± chlorite and sparse carbonate. Pyrite, chalcopyrite and smectite also occur in a crosscutting vein. The pyrite is partly of low temperature origin with abundant inclusions of marcasite or a microporous texture but there are also large grains of probably primary pyrite. The magnetite is also granular and there are interstitial patches of chalcopyrite as well as separate masses of chalcopyrite to 2mm long with abundant inclusions of smectite and carbonate/

**HOB06-12, 84.5m**

**Folded muscovite-biotite schist with quartz in veins and lenses as well as folded chlorite-biotite lamellae and post-tectonic chlorite: very minor sulphide is present in veins and disseminated (pyrite > chalcopyrite?): metapelite.**

Mineral	Abundance	Character
Muscovite	Dominant	Schistose, crenulated
Quartz	Abundant	Recrystallised/in veins
Biotite	Minor	Schistose, in lamellae
Chlorite	Minor	Schistose/post tectonic
Oxide	Accessory	Disseminated
Sulphide	Trace	In lamellae and veins.

This sample has large areas of muscovite schist with a crenulated schistosity and quartz veins from 2mm to more than 5mm wide passing into silicified zones in the schist. Bedding seems to be defined by lamellae rich in schistose chlorite and possibly residual biotite with folds that have the main schistosity as axial plane. Sparse quartz-rich lenses also seem to have been folded about this schistosity but are short parallel to the schistosity and seem to represent silicified schist (as indicated above) rather than primary quartz-rich metasediment. There are also disseminated post-tectonic chlorite crystals to 3mm long in the schist and aggregates of coarse decussate muscovite and chlorite in a large quartz vein. The quartz veins are partly parallel to the schistosity and partly parallel to the crenulation cleavage and contain chlorite, muscovite, fine-grained magnetite and sulphide (pyrite > chalcopyrite?). Rare sulphide also occurs adjacent to one of the folded biotite-chlorite lamellae. The chlorite commonly has pleochroic haloes around microcrystalline radioactive grains, suggesting metapelite.



**HOB06-14, 31.8m**

**Quartz-rich quartz-biotite-muscovite schist with garnet, post tectonic chlorite, magnetite, apatite and zircon: cut by partly clay-limonite-filled fracture.**

Mineral	Abundance	Character
Quartz	Dominant	Recrystallised
Biotite	Minor	Weakly schistose
Muscovite	Very minor	Schistose
Chlorite	Very minor	Post tectonic
Garnet	Very minor	Fine-grained
Magnetite	Very minor	Fine-grained
Apatite, zircon	Accessory	Detrital

This sample is quartz-rich with quartz from 0.05mm to 0.4mm in grainsize and weakly schistose biotite. Less abundant muscovite occurs but is not present throughout. Early garnet occurs as partly irregular grains to 0.3mm in diameter and there is minor post tectonic chlorite. Oxide is disseminated and may be magnetite but apatite and zircon are also disseminated, with zircon from 0.03mm to 0.15mm long, suggesting medium-grained sandstone. A partly clay-filled fracture is at a high angle to the schistosity.

**HOB06-15, 36.3m**      **Altered quartz-biotite-feldspar schist with magnetite, apatite and sparse pyrite attached to quartz veins and to patches of chlorite  $\pm$  limonite  $\pm$  adularia.**

Mineral	Abundance	Character
Quartz	Major	Recrystallised
Biotite	Abundant	Weakly schistose
Sericite-albite	Common	Ex-feldspar
Chlorite	Minor	Weakly schistose/ex-biotite
Magnetite	Very minor	Metamorphic?
Apatite	Accessory	Detrital
Pyrite $\pm$ chlorite, limonite, adularia	Very minor	Secondary

This sample seems to have been quartzofeldspathic with abundant quartz and widely disseminated albite-sericite aggregates apparently derived from plagioclase. Biotite and less abundant chlorite define a recrystallised schistosity, with some fine-grained poorly oriented chlorite and disseminated magnetite. Apatite is disseminated but no obvious zircon was seen. Sparse patches of pyrite occur, to 2.5mm long, partly attached to crosscutting narrow quartz veins but also composite with chlorite  $\pm$  limonite  $\pm$  adularia. Other crosscutting quartz-filled fractures lack sulphide, however. This sample seems to have been quartzofeldspathic metasandstone.