EL-25399 COMPASS CREEK
Northern Territory

Annual Report
Period: 10/04/2009 to 09/04/2010

Review of Gold Potential

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Summary

Hapsburg Exploration Pty Ltd was granted EL-25399 in April 2007. The tenement, known as Compass Creek, consists of 16 sub-blocks and is about 53.4 km$^2$ in area. The tenement is located about 130 km south-east of Darwin, 55 km NNW of Pine Creek and about 15 km east of Ban Ban Springs.

The Compass Creek tenement is within the old “Mt. Wells Policy Reserve” which existed from 1964 to June 1988. This Policy Reserve restricted exploration in the area to small scale prospecting only. Hence no significant work was done by major exploration companies during this period.

Most early exploration around Compass Creek was focussed on trying to find gold and/or tin deposits. The closest significant mines are the Mount Wells tin mine, located about 8 km south-east, and the Woolwonga and Yam Creek Group of gold mines located about 7 km west and 10 km south-west of Compass Creek respectively.

The Compass Creek tenement is located near the centre of the Pine Creek Orogen (PCO). The PCO is a major sedimentary basin up to 14 km thick, and covers a present area of about 66,000 km$^2$ in the north central part of the Northern Territory. The PCO consists of Early Proterozoic (2470 – 1870 Ma) fluvial to marine sediments deposited in a spreading/ rift basin unconformably resting on an Archaean basement of granite-gneiss domes. The PCO is made up of an alternating sequence of psammitic and pelitic sediments with minor carbonate and volcanic rocks. Mafic sills (Zamu Dolerite) of a continental thoelitic suite of rocks were intruded prior to the Lower Proterozoic orogeny.

The PCO was subject to deformation and metamorphism between 1870 and 1780 Ma. During this period the tensional regime that had opened the sedimentary basin, change to compression in an east-west direction (F-1). This caused the sediments in the centre of the basin to become tightly to isoclinally folded, and developed a strong axial plane cleavage. The units in the centre of the PCO (geosyncline) were subject to regional lower greenschist facies metamorphism. The mafic sills of the Zamu Dolerite were altered to amphibolites.

The central part of the PCO is cut by a major fault/shear zone that occurred just prior and possibly during the major granitic intrusive event. This is known as the Pine Creek Shear Zone (PCSZ) and extends through the centre of the Pine Creek Orogen, from Katherine in the SSE, to near Darwin in the NNW; a distance of over 200 kilometres. The width of the PCSZ is at least 10 km and possibly wider in places.

The Lower Proterozoic sequence of the PCO was intruded by a series of granitoids between 1840 and 1780 Ma. These intrusions are related to a major orogeny between 1870 to 1780 Ma. In the central part of the PCO a granitic intrusive event (Cullen Batholith) occurred between 1830 – 1800 Ma, near the end of the deformation events. The Cullen Batholith intrusives are widespread and created broad aureoles of metamorphism and metasomatism from 500 m to 10 km from the contact. It is likely that the broader aureoles indicate that the granite extends at shallow depth beneath these aureoles. Albite-epidote hornfels is present in all contact aureoles, commonly with a narrow inner zone of hornblende hornfels.

In 1870 coarse alluvial gold was found at Yam Creek (12 km SSW from Compass Creek) while crews were digging holes for the overland telegraph line. This started a major gold...
rush in the central PCO, and by the turn of the century all of the major gold mines had been found. By 1915 gold mining had virtually ceased, and it wasn’t until the modern gold exploration in the early 1980’s that led to the resumption of gold mining in 1986. This modern exploration and mining targeted the 250 known gold mines and prospects, with only minor effort spent on “grass-roots” exploration. With the possible exception of the Glencoe and Goodall mines, it would appear no new discoveries have been made during the modern era.

Total gold production from the PCO to the end of 1998 (NT DME production records), was about 115.5 tonnes (3.71 mill oz). It is likely that this number vastly underestimates the amount of gold won from alluvial and shallow surface mines, due to the fact that goldfield records were not kept until 10 or 20 years after the goldfields were discovered. Current resource estimates indicate over 5.0 million ounces remain in 15 to 20 mines throughout the central Pine Creek district, with the majority occurring in 5 or 6 mines.

The gold mineralisation within the PCO is preferentially developed within strata of the South Alligator Group (especially above the Middle Koolpin Formation) and lower parts of the Finniss River Group (ie, lower parts of the Burrell Creek Formation), and is largely located within the metamorphic aureole of the granitic intrusives of the Cullen Batholith (generally within 5 km of the intrusive).

It is apparent that the gold mineralisation in the PCO is spatially and temporally related to the granitic intrusives of the Cullen Batholith, and that the formation of gold deposits is controlled by structures (fluid pathways & pressure release), decrease in temperature away from the intrusive (500 – 1000m above the carapace) and possible chemical interaction with favourable host rocks (enhancing precipitation). Fluid inclusion and stable isotope studies (Bajwah, 1994) of various gold, base metal and tin deposits in the Central PCO show a significant overlap of isotope values and formation temperatures. Therefore it was concluded that most mineralisation originated from the granitic magmas and that the various types of mineralisation can be found together. However, it is reasonable to assume that significant tin mineralisation is more likely to occur closer to the intrusives in higher temperature regimes such as greisen zones.

Gold occurs within or on the edges of quartz veins carrying varying amounts of pyrite, arsenopyrite, pyrrhotite, chalcopyrite (and a variety of other copper sulphides), galena, sphalerite, bismuthinite, tetrahedrite and locally native bismuth and copper. The gangue minerals are generally quartz, minor siderite, tourmaline (dravite), biotite, muscovite and chlorite. Gold occurs mostly as very fine grains in micro-fractures within sulphides and sometimes within quartz crystals. Wall rock hydrothermal alteration associated with the mineralisation consists of sericite, quartz, carbonate (calcite & minor siderite), chlorite, K-feldspar, tourmaline, apatite and fine grained sulphides of pyrite, arsenopyrite and pyrrhotite.

In the Central part of the Pine Creek Orogen all known gold deposits occur within the 5 km contact (metasomatic) aureole of the post orogenic I-type granites that make up the Cullen Batholith. Tin and other metal mines are also mainly within these alteration aureoles.
The Compass Creek tenement covers the contact between the Prices Springs Granite (I-type) to the south-west and the South Alligator Group and the Finnis River Group of sediments to the north and north-east. Almost all the contact aureole in the sediments is covered by the tenement. In the southern half of the tenement, the combination of higher topography due to resistant sediments, and a weak aeromagnetic response over the same area, is thought to be related to shallow underlying Prices Springs Granite. The higher terrane is likely due to harder rock created by metasomatism, while the weak magnetic response is typical of all the Cullen granites. The presence of strong hydrothermal alteration and a breccia pipe at Kamas Cauldron and breccia vein at Jason’s Peak are also indicative of an intrusive at a relatively shallow depth.

**Previous exploration in the Compass Creek area (1988 – 1995)** was limited to stream sediment and rock chip sampling, geologic mapping and landsat structural interpretation. No trenching or drilling of any kind has been documented in the Compass Creek area. The limited surface exploration did show widespread anomalous rock chip samples for Sn-As-Pb-Ag and weak values of Cu, Au & Nb; while BCL stream sediment sampling did show a moderate gold anomaly about one kilometre north of Jason’s Peak. The regional structural interpretation showed the strong NW-SE Pine Creek Shear Zone plus several cross structures (NE-SW & E-W) and several circular structures of unknown origin. Past mapping and rock chip sampling also located the three breccia/gossan prospects known as Kamas Cauldron, Jason’s Peak and Mount Hewson; as well as the Mavis tin mine. Also a major WNW trending quartz-brecia vein is present in the SW quarter of EL-25399. This major vein forms a prominent ridge extending over 3 km in length, with over half of this length outside the western boundary of EL25399. A second smaller quartz vein (1m wide) is reported to occur within the Prices Springs Granite where the northern tip of the granite is located in the SW quarter of EL-25399. The vein is reported to trend 2 km NW-SE just inside and sub-parallel to the granite contact with metasediments. Another significant exploration target is an aeromagnetic high located 1.5 km SW of the Mavis tin mine, and occurring on the contact of the Prices Springs Granite. This magnetic high may represent a pyrrhotite bearing skarn or mineralised body (greisen?) that could host significant tin and other metals. This magnetic anomaly is outside EL-25399, so arrangements need to be made to acquire the two sub-blocks south of the Mavis tin mine.

**Geoscience Australia’s Airborne Tempest Electro-Magnetic Survey:** In November 2008, Fugro Airborne Surveys (FAS) completed an airborne electro-magnetic survey (AEM) over Hapsburg’s Compass Creek tenement (EL-25399). FAS flew 34 lines over the tenement at a spacing of 238m. A Geophysicist (David McInnes) interpreted the Tempest Airborne Electro-Magnetic survey and concluded there were two significant AEM anomalies that occur on the deeper depth slices of the AEM data (deepest being 150 to 200m). The most prominent AEM response was over the Mavis Tin Mine, where it appears to be about 1400m long and 500m wide. McInnes has attributed it to two NNW trending lineaments (faults/veins) that may contain graphite (and/or sulphides). The second AEM response is much smaller and weaker, and is located near the centre of EL-25399. This AEM response appears to trend NE-SW for about 250m, and may be within a fault on this trend that shows in the airborne magnetic data. The presence of two significant AEM anomalies on the deepest depth slice has provided definite drilling targets for possible sulphide related gold, base metals and tin, and/or uranium occurring with graphite.
Field Reconnaissance of Kamas Cauldron and Jason’s Peak: Brief field visits were made to these two prospects in early August 2009. Both prospects display metasomatic alteration (hornfels) related to a nearby intrusive body, and a later hydrothermal alteration related to breccia-veins and bodies. Relatively massive wall rock material consists of phyllic altered metasediment (silica-sericite) with 1-5% variably sized cubic to rounded voids (2-10mm). The voids are thought to represent metasomatic mafic porphyroblasts that were then probably replaced by chlorite and pyrite during hydrothermal alteration. The rock is cut by occasional quartz and breccia veins up to 1cm wide.

Kamas Cauldron: consists of a relatively flat-topped hill that hosts an 80m diameter zone (pipe?) of variably brecciated metasediment that has undergone both metasomatic and hydrothermal alteration. The breccia is host to 10-30% iron oxide boxworks (and infill) and common quartz veining in the matrix and fractures. The breccia zone is surrounded by a 1-3m rim of resistant phyllic altered metasediment that forms the edge of the flat top hill. Analyses of 35 elements revealed that the seven samples from Kamas Cauldron were weakly anomalous in silver, bismuth, phosphorous and antimony; and moderate to strongly anomalous in arsenic, lead and tin. Gold, copper and zinc are only very weakly anomalous.

Jason’s Peak: forms a sharp narrow ridge about 60-70m long, 15-25m wide and trending about 330° (MN). The base of the steep part of the ridge (cliffs etc.) is about 200m long and 60m wide. Several breccia-veins occur as narrow (1m) bodies cutting the metasomatic and hydrothermally altered host metasediment (similar to that at Kamas Cauldron). Breccia-veins about 1m wide occur on both ends of the ridge and trend about the same direction of 010° to 015° (to MN) and dip +/- vertical. A breccia knob (pipe?) about 3 x 6m in area occurs just to the NW of the north end of the ridge. Analyses of 35 elements revealed that the five samples from Jason’s Peak were weak to moderately anomalous for gold, silver and bismuth; while moderate to strongly anomalous results were returned for arsenic, phosphorous, lead, antimony and tin. Copper and zinc are present in weak amounts; but as for Kamas Cauldron, it is possible that acid weathering has leached these two elements from the surface exposures. It is quite likely that a supergene copper zone will exist around the water table; and it is also possible a supergene gold zone may also be present.

Recommendations

Hapsburg’s EL-25399 has significant exploration potential for gold, silver and base metal mineralisation associated with hydrothermal breccias and structurally controlled quartz-sulphide veins. Also there is potential for stockwork or greisen style tin deposits (+/- basemetal & gold). The significant airborne electro-magnetic (AEM) anomaly at the Mavis Prospect and the smaller central anomaly should be tested by deep drilling (>250m). The magnetic anomaly just south-west of the Mavis tin mine should be drilled to test for a magnetite or pyrrhotite skarn (or greisen) with possible Sn & Au mineralisation. The potential for uranium is unknown, but it should be tested where uranium could have been released with magmatic volatiles, and may have been enriched in structures and/or sediments where a reducing environment (graphitic schist or mafic dyke) is cut by the structure and hydrothermal system. The AEM anomaly at the Mavis Prospect could also be a uranium target if the conductor is caused by graphitic schist.
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**Introduction**
Hapsburg Exploration Pty Ltd was granted EL-25399 on the 10th of April 2007. The tenement, known as Compass Creek, is located about 130 km south-east of Darwin, 55 km NNW of Pine Creek and about 15 km east of Ban Ban Springs (Fig 1). The tenement consists of 16 sub-blocks and is about 53.4 km$^2$ in area. There are no current mineral claims or mining leases within the EL, and the EL is covered by the McKinlay River (5271) 1:100,000 sheet and the Ban Ban (14/3-111) 1:50,000 sheet.

The Compass Creek tenement is within the old “Mt. Wells Policy Reserve” which existed from 1964 to June 1988. This Policy Reserve restricted exploration in the area to small scale prospecting only. Hence no significant work was done by major exploration companies during this period. Minor surface stream and rock chip sampling for gold was conducted by several companies between 1988 and 1995, while no work was reported between 1995 and 2007 when Hapsburg acquired the tenement. No ground geophysical surveys or drilling have been reported (or are known) within the tenement area.

Most early exploration around Compass Creek was focussed on trying to find gold and/or tin deposits. The closest significant mines are the Mount Wells tin mine, located about 8 km south-east, and the Woolwonga and Yam Creek Group of gold mines located about 7 km west and 10 km south-west of Compass Creek respectively.

This report provides a review of the known geology, the surrounding mineral deposits and past exploration done in the region, with emphasis on the prospectivity of the Compass Creek tenement (EL-25399). The report also presents the results of recent work done by Hapsburg and Geoscience Australia (GA) done during this reporting year.

**General Geology**
**Early Proterozoic Sedimentary Basin**
The Compass Creek tenement is located near the centre of the Pine Creek Orogen (PCO) (Fig 2). The PCO is a major sedimentary basin up to 14 km thick, and covers a present area of about 66,000 km$^2$ in the north central part of the Northern Territory. The PCO consists of Early Proterozoic (2470 – 1870 Ma) fluvial to marine sediments deposited in a spreading/rift basin unconformably resting on an Archean basement of granite-gneiss domes. The PCO is made up of an alternating sequence of psammitic and pelitic sediments with minor carbonate and volcanic rocks. Mafic sills (Zamu Dolerite) of a continental thoelitic suite of rocks were intruded prior to the Lower Proterozoic orogeny.

**Stratigraphy**
The oldest formation outcropping in the centre of the PCO is the Masson Formation which is exposed in the core of the Mount Masson Anticline and consists of carbonaceous and dolomitic pelites (Fig 3). The Masson Formation is overlain (disconformably?) by the three units of the Mount Partridge Group. The lower unit of the Mount Partridge Group is the Mundogie Sandstone which consists of a sequence of coarse grained psammites (sandstone/quartzite) with minor interbedded pelites (siltstones). These units were deposited in a high energy environment, and probably represent a period of uplift and rapid erosion. These quartzites and siltstones outcrop as steep strike ridges. The Mundogie Sandstone is conformably overlain by two units of the Wildman Siltstone; a lower hematitic, dominantly pelitic unit, and an upper sequence of interbedded pelites and quartzose sandstone.
The Mount Partridge Group is unconformably overlain by iron-rich sediments, carbonates and tuffs of the South Alligator Group (Figs 5 & 5a). The oldest formation in the South Alligator Group is the Koolpin Formation which consists of pyritic, carbonaceous shale, ferruginous sandstone and chert, plus minor carbonate and iron formations which were deposited in a shallow marine environment. The Koolpin Formation is unconformably overlain by the Gerowie Tuff which consists of black cherty tuff and grey siliceous pelites. This tuff was the product of felsic volcanism dated at 1880Ma (Stuart-Smith et al 1986). The Gerowie Tuff is overlain by, and grades into, the Mount Bonnie Formation, which is a transitional unit between the predominantly volcanic units of the Gerowie Tuff and the greywacke units of the overlying Burrell Creek Formation. The base of the Mount Bonnie Formation is marked by a one metre thick greywacke unit, and the top is defined by the last one metre thick tuffaceous unit.

The Burrell Creek Formation is part of the Finniss River Group and is the youngest Lower Proterozoic stratigraphic unit in the centre of the PCO. The lithologies present include hematitic siltstone, shale and greywacke. The greywacke content increases towards the east. The Burrell Creek Formation represents a change in conditions to deeper water flysch style sedimentation. The shales and slates of this unit outcrop as low hills in the McKinlay and Margaret River catchments. This represents the last episode of Early Proterozoic deposition in the PCO.

**Lower Proterozoic Orogeny**

The PCO was subject to deformation and metamorphism between 1870 and 1780 Ma. During this period the tensional regime that had opened the sedimentary basin, change to compression in an east-west direction (F-1). This caused the sediments in the centre of the basin to become tightly to isoclinally folded, and developed a strong axial plane cleavage. The units in the centre of the PCO (geosyncline) were subject to regional lower greenschist facies metamorphism. The mafic sills of the Zamu Dolerite were altered to amphibolites.

Between 1870 and 1780 Ma five phases of deformation are recorded as 1) north trending monoclinal warping, 2) thrusting and recumbent folding, 3) north to northwest trending non cylindrical, closed to tight folds, 4) open small amplitude regional folding related to granitic intrusions, and 5) kinks and drag folds related to movement on major faults. The major deformation events created a regional greenschist metamorphic facies and produced a regional north-west trending structural fabric.

The central part of the PCO is cut by a major fault/shear zone that occurred just prior and possibly during the major granitic intrusive event (see below). This is known as the Pine Creek Shear Zone (PCSZ) and extends through the centre of the Pine Creek Orogen, from Katherine in the SSE, to near Darwin in the NNW; a distance of over 200 kilometres. The width of the PCSZ is at least 10 km and possibly wider in places. However sub-parallel (related) shear zones may confuse the actual width and location of the PCSZ.
**Lower Proterozoic Granitic Intrusions**

The Lower Proterozoic sequence of the PCO was intruded by a series of granitoids between 1840 and 1780 Ma. These intrusions are related to a major orogeny between 1870 to 1780 Ma (see above). In the central part of the PCO a granitic intrusive event (Cullen Batholith) occurred between 1830 – 1800 Ma, near the end of the deformation events. Older granitic intrusives (1870-1840 Ma) occur near the eastern and western boundaries of the PCO, and are not related to the Cullen Batholith (not discussed here).

The main intrusive granitoids in the centre of the PCO are the Margaret, Burnside, Shoobridge, Fenton, Prices Springs and McKinlay intrusions which are all part of the Cullen Batholith. The Cullen Batholith consists of at least fifteen separate intrusions with seven additional satellite plutons. The granitoid types range from granite, through granodiorite to monzodiorite (Bajwah, 1994). In the centre of the PCO the plutons range in composition from granite to quartz syenite (Stuart-Smith & Needham 1984).

The Cullen Batholith intrusives are widespread and created broad aureoles of metamorphism and metasomatism from 500 m to 10 km from the contact. It is likely that the broader aureoles indicate that the granites extends at shallow depth beneath these aureoles. Albite-epidote hornfels is present in all contact aureoles, commonly with a narrow inner zone of hornblende hornfels. Locally the metamorphic aureoles developed andalusite crystals in pelitic units and amphiboles in the mafic sills of the Zamu Dolerite (Page et al. 1980).

The intrusive units of the Cullen Batholith are predominantly I type granites and are suggested to have magnetite as a common accessory. However, the airborne magnetic survey over the central PCO, show the granitic bodies to have a distinctly low magnetic response. This feature can be used to indicate the areas with granite at shallow depth below the metasediments.

**Gold Mineralisation in the Pine Creek Orogen (PCO)**

Gold was first discovered in the PCO in 1865 at the Finniss River; however this was not economic. In 1870 coarse alluvial gold was found at Yam Creek (12 km SSW from Compass Creek) while crews were digging holes for the overland telegraph line. This started a major gold rush in the central PCO, and by the turn of the century all of the major gold mines had been found. By 1915 gold mining had virtually ceased, and it wasn’t until the modern gold exploration in the early 1980’s that led to the resumption of gold mining in 1986. This modern exploration and mining targeted the old known gold mines, and it would appear that only minor effort was spent on “grass-roots” exploration. With the possible exception of the Glencoe and Goodall mines, it would appear no new discoveries have been made during the modern era.

Over 250 gold occurrences are known in the PCO, and most of these are in the Central Region (Figs 4, 5, 5a, 6, 7 & 8). A few gold occurrences occur in the Litchfield Province and Rum Jungle Region, while the South Alligator River Valley contains some uranium-gold and gold-platinum deposits and the East Alligator River Region contains a few uranium-gold deposits.

Total gold production from the PCO to the end of 1998 (NT DME production records), was about 115.5 tonnes (3.71 mill oz). It is likely that this number vastly underestimates the amount of gold won from alluvial and shallow surface mines, due to the fact that goldfield
records were not kept until 10 or 20 years after the goldfields were discovered. Also, many miners (especially Chinese) were probably reluctant to reveal the true amount of gold won.

The gold mineralisation within the PCO is preferentially developed within strata of the South Alligator Group (especially above the Middle Koolpin Formation) and lower parts of the Finniss River Group (in the lower parts of the Burrell Creek Formation), and is largely located within the metamorphic aureole of the granitic intrusives of the Cullen Batholith (generally within 5 km of the intrusive).

It is apparent that the gold mineralisation in the PCO is spatially and temporally related to the granitic intrusives of the Cullen Batholith (Figs 5 & 6), and that the formation of gold deposits is controlled by structures (fluid pathways & pressure release), decrease in temperature away from the intrusive (500 – 1000m above the carapace) and possible chemical interaction with favourable host rocks (enhancing precipitation). Fluid inclusion and stable isotope studies (Bajwah, 1994) of various gold, base metal and tin deposits in the Central PCO show a significant overlap of isotope values and formation temperatures. Therefore it was concluded that most mineralisation originated from the granitic magmas and that the various types of mineralisation can be found together. However, it is reasonable to assume that significant tin mineralisation is more likely to occur closer to the intrusives in higher temperature regimes such as greisen zones.

There are at least five deposit types or styles of gold mineralisation (Snowden report 2008):

1. Sheeted and stockwork quartz vein systems located along major anticlinal hinges in the Mount Bonnie and Burrell Creek Formations and minor occurrences in the Gerowie Tuff. Mineralisation is hosted by carbonaceous or sulphidic host rocks (Woolwonga) or along zones of competency contrast between greywacke and shale (Enterprise, Union Reefs, Goodall, Alligator, Faded Lily, Chinese Howley, Big Howley, Yam Creek and Fountain Head) or along dolerite contacts (Bridge Creek). Axial planar quartz veins have been identified in some deposits (Enterprise and Woolwonga). Stratabound quartz reefs occur in most of these deposits, and may develop into saddle reefs along fold hinge zones (Enterprise, Union Reefs and Fountain Head).

2. Sediment-hosted stratiform gold mineralisation and quartz-sulphide-vein-hosted stratabound gold mineralisation in cherty ironstone and carbonaceous mudstones of the Koolpin Formation (Tom’s Gully, Cosmo Howley and Rising Tide) or the Gerowie Tuff (Brocks Creek).


4. Sediment-hosted stratiform and stratabound gold mineralisation in cherty, dolomitic and sulphidic shales of the Mount Bonnie Formation, with sheeted quartz-sulphide veins (Rustler’s Roost). And,

5. Sheeted or stockworked quartz-feldspar-sulphide veins hosted by Zamu or Maud Creek dolerite sills (Maud Creek, Chinese Howley South, Bridge Creek and Kazi).
**Gold Vein Mineralisation**
Gold occurs within or on the edges of quartz veins carrying varying amounts of pyrite, arsenopyrite, pyrrhotite, chalcopyrite (and a variety of other copper sulphides), galena, sphalerite, bismuthinite, tetrahedrite and locally native bismuth and copper. Locally other elements may be present in rare minerals (tellurium, nickel etc). The gangue minerals are generally quartz, minor siderite, tourmaline (dravite), biotite, muscovite and chlorite. Gold occurs mostly as very fine grains in micro-fractures within sulphides and sometimes within quartz crystals. Wall rock hydrothermal alteration associated with the mineralisation consists of sericite, quartz, carbonate (calcite & minor siderite), chlorite, K-feldspar, tourmaline, apatite and fine grained sulphides of pyrite, arsenopyrite and pyrrhotite.

**Gold Mines Located Near Compass Creek**
Figs 4 to 8

**McKinlay & Waterdrum Prospects:** Small production came from the McKinlay gold mine located about 5 km east of Compass Creek. Whereas the Waterdrum gold prospect, located 1.5 km west of the SW corner of EL-25399, has no record of production.

**Mount Wells – Horners Creek:** These mines are located about 8 and 6 km SSE of Compass Creek (respectively), and like Compass Creek are also within the NNW-SSE trending Pine Creek Shear Zone (PCSZ). Gold was first discovered in the Mount Wells area about 1875 and tin was discovered in 1881. These prospects were mined mainly for tin (see below) but also produced some copper. Two small prospects located a further 1–2 km SSE (Speargrass & Lewis) were mined for an unknown amount of Au-Ag-Cu and Pb-Sn-Cu.

**Woolwonga mine:** The Woolwonga mine is located about 7 km to the west of Compass Creek. Here, about 6,000 oz of gold was produced from oxide ore at 27.1 g/t Au between 1871 and 1906. In 1985 Dominion Mining Ltd conducted extensive exploration and estimated a reserve of 2.1 Mt at 2.78 g/t Au, within a larger preliminary resource of 5 Mt at 3 g/t Au. GBS Gold International Inc mined about 234,000 oz of gold from open pit ore at 2.5 g/t Au. Gold mineralisation is structurally controlled and occurs in quartz-sulphide veins associated with faults, shears and brecciation within a tight plunging anticline. Higher gold values are associated with a shear zone trending NNW that cuts the axis of an anticline, and is probably related to the PCSZ (subsidiary parallel structure). Host rocks consist of tuffaceous greywacke, mudstone and carbonaceous mudstone of the Mount Bonnie Formation. The main ore mineral association is arsenopyrite and pyrite with lesser marcasite, galena, native bismuth, pyrrhotite, chalcopyrite, sphalerite, covellite and chalcocite. Gold occurs as small free grains in quartz or minute blebs in arsenopyrite.

**Yam Creek, Princess Louise & North Point mines:** These mines represent a NNE trending group of mines located about 10 km south-west of Compass Creek. This group of mines has a combined historic production of at least 12,000 oz of gold from high grade veins, and a combined open pit resource* of around 130,000 oz at a grade of 1.35 g/t Au. It appears these deposits are located within a major cross-cutting structure (Hayes Creek Fault) that trends into the western part of Compass Creek.
**Iron Blow & Mount Bonnie Poly-metallic gold mines:** These mines are located 11 km and 14 km southwest (respectively) of Compass Creek, and just SSW of the Yam Creek group of workings. The deposits consist of massive to semi massive sulphides carrying significant zinc, lead, copper, silver and gold.

The **Iron Blow mine** was discovered about 1873 and a small oxide resource (15,000 t) was mined from 1898 to 1906. Extensive exploration occurred between 1957 and 1974, culminating in a sulphide resource estimate of 0.98 Mt at 6.8% Zn, 0.9% Pb, 117 g/t Ag & 2.1 g/t Au. In 1984 Henry and Walker Group Ltd mined the top 40m for 10,000 t of oxide ore at 9.0 g/t Au and 250 g/t Ag, and 25,000 t of sulphide ore with 7 g/t Au and 360 g/t Ag (?supergene ore) (total~8,500 oz Au). In 1998, Northern Gold NL estimated a resource of 1.07 Mt at 2.16 g/t Au (~74,300 oz Au). A recent resource (Sept. 2009), released by Crocodile Gold Inc, claims 210,000 oz of gold at 2.08 g/t Au and 10.0 M oz of silver at 100 g/t Ag, plus zinc, lead and copper.

The **Mount Bonnie mine** has no early production records (1903 – 1916). However, by 1973 a resource had been defined of 0.48 Mt at 7.67% Zn, 0.4% Cu, 1.8% Pb, 186 g/t Ag, and 1.5 g/t Au. About 12,000 tonnes was mined and put through the Mount Wells Battery (~580 oz Au). In 1979-80 Henry and Walker Group Ltd mined 110,000 t of Mount Bonnie oxide ore grading 7 g/t Au and 230 g/t Ag (~25,000 oz Au). As of 1998, Northern Gold NL estimated a remaining resource of 0.65 Mt at 1.69 g/t Au (~35,000 oz Au).

**Glencoe mine:** This mine is located about 12 km west of Compass Creek. The mine has produced about 3,600 oz of gold at a grade of 2.3 g/t Au, and has an estimated resource* (to 100m) of 1.5 Mt at 1.9 g/t Au (~91,500 oz Au).

**Fountain Head:** This is a group of mines located about 12.5 km west-southwest of Compass Creek. Here recent alluvial production amounted to over 10,000 oz at a grade of 0.2 – 0.4 g/t Au, while the historic vein production was 9,900 oz at an unknown grade. The open pit indicated and inferred mineral resource* at Fountain Head was 108,900 oz at a grade of 1.8 g/t Au in 2007. Much of this has been mined (est~ 67,600 oz), leaving a remaining resource of about 41,300 oz at 1.8 g/t Au. Part of this resource may have been mined in recent years.

**Golden Dyke mine:** The Golden Dyke mine is located about 18 km south-west of the Compass Creek tenement, on the western side of the Golden Dyke Dome. This dome is an area of higher elevation, possibly reflecting more resistant sediments due to stronger metasomatism from underlying granite. Between 1872 and 1936 about 43 kg (1,382 oz) had been recovered from shallow mines. In the 1980s production from the Golden Dyke and several other small deposits was reported as 1.18 t of gold (~40,000 oz). A recent resource estimate was given as 1.6 Mt at 3.8 g/t Au (~195,000 oz).

**Brocks Creek Goldfield:** The Brocks Creek group of mines is located about 20 km WSW of Compass Creek. The mines include Zapopan, Faded Lily, John Bull and Rising Tide. Zapopan (now called Brocks Creek) is being developed as an underground mine, and Rising tide has a modest open pit resource. The area contains westerly trending quartz veins within tuff and siltstone of the Gerowie Tuff. The veins occupy the hinge zone of the WNW trending Zapopan Anticline. Early production from 1885 to 1915 and the retreating of tailings in the 1930s and 1990s produced a reported 26,600 oz of gold. Resource estimates as at 1998 (Acacia Resources Ltd) for all the mines and alluvials in the group was 8.3 Mt at...
1.7 g/t Au (454,000 oz). Mining began in 1996, and to the end of 1998 production was 4.97 t of gold from 3.35 Mt of ore (160,000 oz). As of November 2007, GBS Gold had an underground resource for Brocks Creek of 77,700 oz at 20.5 g/t Au (indicated), 11,500 oz at 12.1 g/t Au (inferred), and a probable reserve of 81,000 oz at 13.0 g/t Au.

**Spring Hill Mine:** This mine is located about 20 km SSE of Compass Creek and is also within the Pine Creek Shear Zone (PCSZ). The deposit consists of narrow quartz veins in a shears that cuts the crest of an anticline. The host rocks are greywacke and siltstone units of the Mount Bonnie Formation. Historic underground production to 105m depth is reported as 679 kg of gold (~22,000 oz). Exploration by Ross Mining NL and Acacia Resources Ltd reported a 1996 resource estimate of 12.75 Mt at 0.8 g/t Au (~328,000 oz). In 2008, Snowden and GBS Gold estimated an “Indicated Resource*” for Spring Hill of 3.6 Mt at 2.34 g/t Au (~270,000 oz).

**Cosmo Howley Group:** The Cosmo Howley group of deposits are located about 25 to 30 km west-southwest of Compass Creek, on a north-northwest trending structure. The group of mines occur over a strike length of 24 km along the crest of an anticline. The group has historic production from 1879 to 1915 of about 2.05 t of gold (~66,000 oz). By 1987, drilling by Dominion Mining Ltd had defined a resource for Cosmo Howley to a depth of 270m of 10Mt at 2.75 g/t Au (~880,000 oz). Mining between 1987 and 1994 produced 14.77 t of gold (~475,000 oz) from 6.94Mt of ore at 2.14 g/t Au. In 1998 an estimated underground resource for Cosmo Deeps was 2.62 Mt at 5.05 g/t Au (~425,000 oz). A recent resource (indicated & inferred mineral resource*) by GBS Gold for the Cosmo Deeps underground project is about 8.75 Mt at 4.4 g/t Au (~1.24 M oz). The “probable reserve” for Cosmo Howley is put at 2.2 Mt at 5.0 g/t Au for 350,000 oz of gold.

**Goodall mine:** The Goodall mine is located about 30 km east of Adelaide River and about 30 km north-west of Compass Creek. Ahmad et.al. report that the mine was discovered in 1981 during a helicopter reconnaissance program of gossan sampling. The initial resource was given as 4.25 Mt at 2.35 g/t Au (~320,000 oz). The mining of this resource produced 7.1 t of gold between 1988 and 1993, from a total of 4.1 Mt at 1.99 g/t Au (~262,000 oz). The deposit is reported to be located on the northern extension of the Howley Anticline in greywacke-shale host rocks of Burrell Creek Formation. Mineralisation is within a north trending quartz stockwork zone of sub-parallel thin quartz-sulphide veins. The zone is 750m long, 50m wide and at least 400m deep.

**Union Reefs and Pine Creek Goldfield:** These large goldfields also occur within the Pine Creek Shear Zone (PCSZ) at about 30 & 50 km respectively, to the SSE of Compass Creek.

**The Union Reefs** area produced 1.76 t (56,600 oz) of gold from 0.58 Mt of ore from 1880 to 1910. Acacia Resources Ltd mined 8.07 t of gold (260,000 oz) by open cut between 1995 and 1998. The remaining resource at 1998 was 17.6 Mt at 1.7 g/t Au (0.96 M oz), plus a new discovery just to the north has 8.1 Mt at 2.21 g/t Au (0.576 M oz). In 2007 GBS reported an “indicated & inferred resource*” for Union Reefs of 1.8 Mt at 1.9 g/t Au (0.112 M oz).

**The Pine Creek Goldfield** (Enterprise, Czarina and several other deposits) is located just west of Pine Creek township, and consists of at least 15 original hard rock mines in a zone 6 km long and 0.5 km wide. The Pine Creek Goldfield occurs along the western margin of the NNW-SSE trending Pine Creek Shear Zone (PCSZ), and is hosted in sheared and contact metamorphosed phyllite and greywacke of the Mount Bonnie and Burrell Creek Formations.
The early gold production between discovery in 1870 and 1915 is difficult to determine, but is estimated to be between 75,000 and 150,000 oz at a grade of around 1.0 oz/t.

Between 1985 and 1993 mining of the Enterprise and Czarina mines, plus several smaller deposits, produced about 774,000 oz from 12.3 Mt of ore at 2.37 g/t Au. The mineralisation at Enterprise occupies the transition zone of greywacke, siltstone, shale, mudstone and chert between the Mount Bonnie and Burrell Creek Formations. The Tabletop Granite outcrops 1 km to the west of the mine, and is interpreted to lie at a depth of 1-2 km below the mine area. The present indicated & inferred “mineral resource*” based on work by Snowden (for GBS Gold International) is 350,000 oz at grades ranging from 1.4 to 3.0 g/t Au, from eight separate prospects.

* Note: The GBS Gold / Snowden “mineral resource” refers to indicated and inferred mineral resources, these are not JORC compliant resource terms.

Tin Discoveries
The Mount Wells mine, locate about 8 km SSE of EL-25399, produced 1690 tonnes of tin concentrate from 1892 to 1956. Since 1957, the Jessops mine, located about 20 km east-north-east of EL-25399, has produced about 200 tonnes of tin concentrate. The Mavis Tin mine, which is located on the southern boundary of EL-25399, was discovered in 1958, and has produced about 4 tonnes of tin concentrate. Other small tin mines (eg. Horners Creek) are located about 6 km SSE of EL-25399. Many other small tin mines and prospects are scattered around the Compass Creek area.
Exploration Potential of the Compass Creek Area

In the Central part of the Pine Creek Orogen all known gold deposits occur within the 5 km contact (metasomatic) aureole of the post orogenic I-type granites that make up the Cullen Batholith (Figs 5 & 6). Tin and other metal mines are also within these alteration aureoles.

The Compass Creek tenement straddles the contact between the Prices Springs Granite (I-type) to the south-west and the South Alligator Group and the Finniss River Group of sediments to the north and north-east. Almost all the contact aureole in the sediments is covered by the tenement. In the southern half of the tenement, the combination of higher topography due to resistant sediments and a weak aeromagnetic response over the same area, is thought to be related to shallow underlying Prices Springs Granite Fig 10). The higher terrane is likely due to harder rock created by metasomatism, while the weak magnetic response is typical of all the Cullen granites. The presence of strong hydrothermal alteration and a breccia pipe at Kamas Cauldron and breccia vein at Jason’s Peak are also indicative of an intrusive at relatively shallow depth.

Many gold, tin and base-metal mines occur within the north-northwest trending Pine Creek Shear Zone (PCSZ) which is about 10 km wide. The granites are younger than the PCSZ and hence the shear planes wrap around the granites. The Compass Creek tenement is wholly within the PCSZ. Many mines and prospects (Au, Sn & basemetal) occur from 8 to 50 km south-southeast of Compass Creek in the PCSZ. Therefore, given that no significant physical exploration has been done in the Compass Creek area, it is reasonable to assume that similar deposits may yet be found at Compass Creek and surrounding areas.

Exploration Highlights from Past Exploration at Compass Creek

The past reconnaissance exploration of the Compass Creek area has highlighted four prospective targets on EL-25399.

1. The elevated and hilly terrane north of the Mavis tin mine (Mavis North) contains the following positive exploration results.
   - Widespread area of historic anomalous rock chip geochemistry (2.5 x 1.5 km) showing high values of Sn-As-Pb-Ag and anomalous amounts of Cu, Au, & Nb.
   - The presence of moderate stream BCL anomaly located about 4 km north of the Mavis tin mine. This may be reflecting mineralisation from Jason’s Peak?
   - Three breccia gossan zones (Jason’s Peak, Kamas Cauldron & Mt. Hewson) are hosted in Mount Burrell Formation sediments that have undergone strong alteration and carry high Sn-As-Pb assays. One of these breccia bodies (Kamas Cauldron) is circular, and has recently been confirmed to be a breccia pipe.
   - A Landsat TM interpretation (by Cyprus/Arimco) shows a 1-2 km diameter circular anomaly located just to the north of the Mavis tin mine (within the elevated hilly terrane). This interpretation also shows a major north-west trending fault lineament projecting through the circular structure. There are also several easterly trending “cross structures” interpreted in this area. The presence of mineralised NW-SE and E-W fault structures is documented from field reconnaissance sampling and mapping. Several circular features and cross lineaments have also been recognised from recent Google Landsat imagery.
   - The regional aeromagnetic survey shows a broad magnetic low over the area to the north of the Mavis tin mine (Fig 10). This could represent the presence of the Prices
Springs Granite at shallow depth, or magnetite destruction due to hydrothermal alteration, possibly from a buried intrusive. Recent airborne magnetics and radiometrics (1999) clearly show the granitic bodies are magnetic lows, and confirms the probability that granite underlies the raised hilly terrane to the north of Mavis Tin mine.

(2) The presence of an aeromagnetic high located 1.5 km SW of the Mavis tin mine, and occurring on the contact of the Prices Springs Granite (Fig 10). This magnetic high may represent a pyrrhotite bearing skarn or mineralised body (greisen?) that could host significant tin and other metals. This target is south of Hapsburg’s EL-25399, therefore a JV has been arranged with the holder of this area.

(3) A major WNW trending quartz-breccia vein is present in the SW quarter of EL-25399. This major vein forms a prominent ridge extending over 3 km in length. Unfortunately, more than half of this quartz breccia vein extends beyond the western boundary of EL25399. The eastern end of this major vein appears to contain higher As and lower Cu, while the western end has anomalous Cu and only weak As. This may be indicating some primary zoning in a hydrothermal system. Occasionally gold is weakly anomalous in rock and soil samples.

(4) A second smaller quartz vein (1m wide) is reported to occur within the Prices Springs Granite where the northern tip of the granite is located in the SW quarter of EL-25399. The vein is reported to trend 2 km NW-SE just inside and sub-parallel to the granite contact with metasediments. One sample from this vein returned 27.8% As & 0.50 g/t Au.

Results of Exploration Conducted in 2009

Geoscience Australia’s Airborne Tempest Electro-Magnetic Survey
In November 2008, Fugro Airborne Surveys (FAS) completed an airborne electro-magnetic survey (AEM) over Hapsburg’s Compass Creek tenement (EL-25399). FAS flew 34 lines over the tenement at a spacing of 238m. This was done in conjunction with a regional program flown for Geoscience Australia at line intervals of about 1.6 km. Hapsburg received the AEM data for EL-25399 in August 2009, and the regional AEM data in September 2009.

In August 2009 Hapsburg commissioned a geophysicist, David McInnes of Montana GIS, to interpret and report on the Tempest Airborne Electro-Magnetic survey (Appendix 6). McInnes concluded there were two significant AEM anomalies that occur on the deeper depth slices of the AEM data (deepest being 150 to 200m) (Fig 9).

Mavis Prospect: The most prominent AEM response was over the Mavis Tin Mine, where it straddles the southern boundary of EL-25399. The AEM response appears to be about 1400m long and 500m wide, and McInnes has attributed it to two NNW trending lineaments (faults/veins) that may contain graphite (and/or sulphides) (Appendix 6 & Fig 9).

The second AEM response near the centre of EL-25399 is much smaller and weaker. It appears to trend NE-SW for about 250m, and may be within a fault on this trend that shows in the airborne magnetic data. Please refer to Appendix 6 for the review by David McInnes. The presence of two clear AEM anomalies on the deepest depth slice has provided definite drilling targets for possible sulphide related gold, base metals and tin, or uranium occurring with graphite.
Field Reconnaissance of Kamas Cauldron and Jason’s Peak
Brief field visits were made to these two prospects in early August 2009. Seven rock chip samples were collected from Kamas Cauldron and five from Jason’s Peak (Figs 12 & 13).

Both prospects display metasomatic alteration (hornfels) related to a nearby intrusive body, and a later hydrothermal alteration related to breccia-veins and bodies. Relatively massive wall rock material consists of phyllic altered metasediment (silica-sericite) with 1-5% variably sized cubic to rounded voids (2-10mm). The voids are thought to represent metasomatic mafic porphyroblasts that were then probably replaced by chlorite and pyrite during hydrothermal alteration. Weathering of these porphyroblasts has left a limonite coating or a spongy limonite-clay material. The rock is cut by occasional quartz veins and breccia veins up to 1cm wide. Hairline quartz-limonite veinlets also occur in fractures, and there is weak limonite staining. The rock appears to be relatively massive as the metamorphic foliation has been destroyed (masked) by the metasomatic and/or hydrothermal alteration.

Kamas Cauldron  790,471 E / 8,515,663 N
The top of the hill at Kamas Cauldron is relatively flat with a gradual tilt to the southeast. This flat area is made up of an 80m diameter zone (pipe?) of variably brecciated metasediment that has undergone both metasomatic and hydrothermal alteration. The breccia is host to 10-30% iron oxide boxworks (and infill) and common quartz veining in the matrix and fractures. The breccia zone is surrounded by a 1-3m rim of resistant phyllic altered metasediment that forms the edge of the flat top hill (see Fig 14 for sample sites).

Analyses of 35 elements by ALS-Chemex (ME-ICP61) revealed that the seven samples from Kamas Cauldron were weakly anomalous in silver, bismuth, phosphorous and antimony; and moderate to strongly anomalous in arsenic, lead and tin. Gold, copper and zinc are only very weakly anomalous, but it is possible that acid weathering has leached these three elements from the surface exposures. It is quite likely that a supergene copper zone will exist around the water table; and the possibility of a supergene gold zone is not out of the question.

Jason’s Peak  789,132 E / 8,516,362 N
Jason’s Peak forms a sharp narrow ridge about 60-70m long, 15-25m wide and trending about 330° (MN). The base of the steep part of the ridge (cliffs etc.) is about 200m long and 60m wide. Several breccia-veins occur as narrow (1m) bodies cutting the metasomatic and hydrothermally altered host metasediment (similar to that at Kamas Cauldron). Breccia-veins about 1m wide occur on both ends of the ridge and trend about the same direction of 010° to 015° (to MN) and dip +/- vertical. It is possible these are one in the same, but equally they could be separate veins. The fact that these breccia-veins are not traceable through the central (high) part of the ridge indicates that they may be at the top of their vein development. A breccia knob about 3 x 6m in area occurs just to the NW of the north end of the ridge. This could be localised at the intersection of two cross structures or could be aligned along a NE trending structure (see Fig 15 for sample sites).

Analyses of 35 elements by ALS-Chemex (ME-ICP61) revealed that the five samples from Jason’s Peak were weak to moderately anomalous for gold, silver and bismuth; while moderate to strongly anomalous results were returned for arsenic, phosphorous, lead, antimony and tin. Copper and zinc are present in weak amounts; but as for Kamas Cauldron,
it is possible that acid weathering has leached these two elements from the surface exposures. It is quite likely that a supergene copper zone will exist around the water table; and the possibility of a supergene gold zone is not out of the question.

**Recommendations**

Hapsburg’s EL-25399 deserves significant exploration to test for gold, silver and base metal mineralisation associated with hydrothermal breccias and structurally controlled quartz-sulphide veins. Also the potential for stockwork or greisen style tin deposits (+/- basemetal & gold), should be evaluated. Both could be economically viable at current metal prices. One of the aims is to test major structural intersections or breccia pipes at depth, to find mineralisation within the hydrothermal system, possibly closer to the magmatic source, or within a more favourable sedimentary unit.

The highly significant airborne electro-magnetic (AEM) anomaly at the Mavis Prospect and the smaller central anomaly should be tested by deep drilling (>250m). Recently the two sub-blocks that cover the southern half of the Mavis tin mine have been acquired by way of a joint venture with the current holder. These two sub-blocks also contain a strong magnetic anomaly that may indicate the presence of a magnetite or pyrrhotite skarn (or greisen) with possible Sn & Au mineralisation.

Also, the SW quarter of EL-25399 contains two major quartz-breccia veins carrying arsenic and low level gold values. Both of these veins need to be examined and assessed for possible drill targets.

The potential for uranium is unknown due to the lack of any testing in the past. However, it is not unusual for uranium to occur with base and precious metal deposits in the Pine Creek region; therefore it would be wise to test for uranium along with tin and precious metals. It is possible that uranium could have been released with magmatic volatiles, and may have been enriched in structures and/or sediments to the north of the Prices Springs Granite, especially where a reducing environment (graphitic schist or mafic dyke) is cut by the structure and hydrothermal system. The AEM anomaly at the Mavis Prospect could also be a uranium target if the conductor is caused by graphitic schist.
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February 2008
### Appendix 1

Location & Resources of Gold Mines & Prospects in the Central PCO

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<td><strong>5,135,500</strong></td>
<td><strong>7.74</strong></td>
</tr>
</tbody>
</table>

* Indicated and Inferred Mineral Resource

Resources estimated from Ahmad et al. (1999) and Snowden Report (2008)

Note: AMG grids are in GDA-94
Appendix 2

Compass Creek Rock Chip Descriptions

Recon Sample

CC-003 13º 25’ 40” S / 131º 40’ 48” E
Consists of white (bull) quartz vein with local patches of vuggy gossanous material and locally some fragments of wall rock. Trace arsenopyrite noted. The host rock is a fine grain metasediment (thought to be Burrell Creek Formation) with a strong foliation trending 330º +/- 10º (to MN) and +/- vertical. This is the same trend as the Pine Creek Shear Zone. The quartz vein zone consists of discontinuous plugs and gashes over a zone up to 50m wide in the same trend as the foliation. This is most likely a metamorphic sweat vein (stage 1 vein) that is unrelated to the granitic mineralising event.

Kamas Cauldron (CC-004-10)

CC-004 13º 24’ 43.9” S / 131º 40’ 55.4” E
Sheared and broken (brecciated) metasediment altered to sericite and quartz with abundant boxworks/vughs (10-50%) after pyrite and other sulphide minerals. Some pieces are completely flooded with iron oxide. Hairline and occasional 0.5cm quartz veins are present. Alteration has destroyed much of the metamorphic foliation, while original quartz grains survive. The assay sample consists of 12 or more chips from five sites of float/sub-outcrop within a 10m² area on top of Kamas Cauldron.

CC-005 13º 24’ 43.6” S / 131º 40’ 56.1” E
The sample consists of broken and brecciated foliated (& sheared) metasediment with abundant quartz veining and iron oxide boxworks (10-30%) and iron flooding (trace specular hematite?). The metasediment has been strongly altered to sericite and quartz. Random sample from 5 or 6 float / sub-outcrop pieces over 5m by 5m area (25m²).

CC-006 13º 24’ 44.6” S / 131º 40’ 56.2” E
Sample of altered metasediment (greywacke?), which is now a medium-grained sericite (quartz) schist with iron staining around fractures with occasional iron oxide boxworks along fractures. Some pieces are completely flooded to a red-brown colour. Sample is from 6 or 7 pieces of sub-outcrop over a 4m x 4m area.

CC-007 13º 24’ 44.2” S / 131º 40’ 56.9” E
Brecciated rock and quartz vein material with abundant medium to coarse grained iron oxide boxworks (10-70%). Cubic pyrite casts are obvious and other sulphide minerals are likely present. The fragments of rock are metasediment altered to fine grained sericite (& quartz), and stained yellow-brown by limonite (FeOx). Sample contains one piece of coarse grained quartz with coarse grained iron oxide sulphide boxworks. The sample was collected from 9 pieces of sub-outcrop / float boulders over a 2m x 4m area; all within 1-3m of the silica-sericite altered rim of the Kamas Cauldron (see sample CC-008).
CC-008  Located 1-3m east of CC-007
Sample of the alteration rim that occurs around the edge of the top of the hill, and encompasses the brecciated and quartz-sulphide veined core of the hill. Silicified and sericitised (& chloritized?) metasediment (greywacke?). The alteration has destroyed (masked) the metamorphic foliation. About 1-3% disseminated iron oxide occurs in fine to coarse grained cubic to rounded casts (0.1-0.5cm) after porphyroblasts of mafic minerals and replacement pyrite and chlorite etc.. It is inferred that early metasomatism would have formed mafic porphyroblasts that these were subsequently altered to a mixture of chlorite and sulphides (& carbonate?). Apart from wide-spaced quartz limonite fracture veinlets, there is little if any obvious mineralisation in this altered rim material.

CC-009  13° 24' 45.9” S / 131° 40’ 56.5” E
Boulders and sub-outcrop of breccia with quartz vein matrix carrying 40-60% medium to coarse grained (1-3mm) iron oxide casts of sulphides (including cubic [pyrite] casts) and limonite coatings and filling of voids. Occasional metasedimentary fragments that are strongly phyllic altered with up to 30% disseminated boxworks many of which are cubic (ex-pyrite?). The limonites vary from red-brown to black with local orange to yellow-brown limonite (jarosite?) and trace specular hematite. Occasional later hairline quartz veinlets cut the breccia and boxworks material. The strongly phyllic to silicic altered metasediment rim (with coarse cubic to rounded casts) occurs about 3-5m to the west of this breccia-gossan sample.

CC-010  13° 24' 45.2” S / 131° 40’ 56.0” E
This is a sample of float and sub-outcrop (~10 pieces) from a 10m x 10m area near the centre of the peak of Kamas Cauldron (flat top peak). All sample pieces consist of strongly altered (phyllic?) metasediment with abundant disseminated iron oxide boxworks and clusters after pyrite and possible mafic minerals (similar to the altered rim rock). Quartz-gossan veining is common, with silica-sericite material occurring locally as layers in the veins (wall rock slivers?). Also contain locally dense (massive) fine grained iron oxide material. It is inferred these rock pieces are from a coarse breccia body, or at least a strongly fracture and broken mass of rock.

South-West of Kamas Cauldron
CC-011  13° 24’ 51.4” S / 131° 40’ 49.6” E
This sample is from a quartz vein just to the south-west of the Kamas Cauldron hill, so may not be related to the breccia type mineralisation. The quartz vein zone is about 5m wide and trends 290° to MN, with the largest individual vein being about 1m wide. The veins are white (bull) quartz with local gossan zones. Part of the sample also contains some weak to moderate chlorite altered metasediment wall-rock. The metasediment contains angular to cubic chlorite porphyroblasts up to 2mm diameter (after mafic minerals?). These porphyroblasts are presumably part of the hornfels/metasomatism related to a nearby intrusive. However, it is not clear if this quartz vein is of metamorphic or magmatic origin.
Sample of vein float material from the Mavis Tin Mine

CC-012  Mavis Diggings  789145 E / 8513390 N

Various float of mine dump material consisting of two phases of partly gossanous quartz vein. The first phase is a coarse grained white (bull) quartz which has been broken and cut by a pale grey medium to coarse grained quartz which often has open vughs often filled with orange-brown clayey material, and locally iron oxide material (ex iron sulphides?). The greyish quartz also carries fine grained grey minerals (in part needles – tourmaline? And/or cassiterite). Occasional fragments of greenish-yellow material may be highly altered metasediment fragments. Trace fresh arsenopyrite also noted in the greyish quartz. It appears that the early white (bull) quartz has been broken and invaded by a lower temperature greyish quartz that carried a variety of minerals with it. It is possible the white (bull) quartz is of metamorphic origin and has been cut by a later magmatic quartz event using the same structure.

Jason’s Peak (CC-013-17)

CC-013  789127 E / 8516384 N

Sample is from a breccia-vein (fault) 0.5 to 1.0m wide trending 010° (to MN), +/- vertical. The vein is located just above a cliff on the north end of the ridge (Jason’s Peak). The vein is exposed in what appears to be an old prospector digging such as an adit or trench.

This fault/vein appears to made up of brecciated and comminuted wall rock (clay) with stringers of quartz veins. The weathered product is a yellow-brown to red-brown and locally dark brown spongy material. Quartz veins (<5cm) and veinlets occur throughout, and some silicification is present. Limonite casts (ex sulphides?) are also present throughout. Wall rock consists of silicified and sericitised metasediments with 5-20% iron oxide lined vughs after mafic minerals and pyrite. These porphyroblasts are presumably related to granitic metasomatism and then converted to chlorite and pyrite during hydrothermal alteration.

CC-014  789123 E / 8516380 N (about 8m from CC-013)

Samples from boulders of float and sub-outcrop over a 3m x 3m area on the NW corner of the ridge top. The sample consists of breccia-vein material plus highly altered wall rock. The location of the float/sub-outcrop probably indicates a different breccia-vein (fault) than that noted at CC-013. The sample consists of strongly phyllic altered wall rock with 30-60% iron oxide lined and spongy (gossan) vughs up to 2cm diameter. Voids often have secondary minerals growing in them. Trace to minor quartz veining along fractures and in spongy limonite (gossan?) zones.

CC-015  789132 E / 8516362 N (near central high point of the ridge)

Outcrop sample of relatively massive wall rock material consisting of phyllic altered metasediment (silica-sericite) with variable sized cubic to rounded voids (2-10mm). These voids are thought to represent metasomatic mafic porphyroblasts that were probably replaced by chlorite and pyrite during hydrothermal alteration. Weathering of these porphyroblasts leaves a limonite coating or a spongy limonite-clay material. The rock is cut by occasional quartz veins and breccia veins up to 1cm wide. Hairline quartz-limonite veinlets also occur in fractures, and there is weak limonite staining. The rock appears to be relatively massive as the metamorphic foliation has been destroyed (masked) by the metasomatic and/or hydrothermal alteration. The ridge trends 310° to 330° (to MN) and is 15 to 25m wide to the steep drop on either side of the ridge. This is a sample of the alteration aureole and is not expected to carry significant mineralisation.
**CC-016 789150 E / 8516338 N (southern end of the ridge)**
Outcrop and sub-outcrop of 1m wide breccia-vein (or pod) trending 015° (to MN) and appears +/- vertical. The breccia vein is located on the southern edge of the ridge, above a sharp cliff face. The sample consists of vuggy breccia with quartz veins and fragments of variably altered metasediment (clay-sericite-silica). Cubic voids close to quartz veins appear to be ex-pyrite, while larger cubic and rounded voids in the metasediment are probably altered porphyroblasts after mafics altered to clay, chlorite and pyrite. Yellow-brown to orange brown limonite staining is common, and locally a yellow-green “limonite” is present in voids. The breccia-vein is exposed over a strike of 5-6m and 1m width. Locally white (bull) quartz vein pieces are present to 2-3cm.

**CC-017 789105 E / 8516386 N (knob of breccia off the NW end of the ridge)**
Rock chip sample across about 6m of a large knob of breccia that outcrops just off the NW end of the Jason’s Peak ridge. Sample consists of 12-15 chips E-W across the base of the breccia knob. The knob has a height of 3-4m.

The breccia consists of phyllic to silicified metasediment fragments cut by many quartz veins and veinlets, and filling breccia voids. Quartz veins commonly contain iron oxide boxworks and clusters after sulphides, while metasediment fragments have large cubic to circular voids (ex altered mafic porphyroblasts). Breccia matrix also has orange-brown clayey material (ex gouge?) with irregular quartz veinlets through it.

On the NW side of the breccia knob there is preserved wall rock metasediment with relic bedding and foliation trending 340° (to MN) and +/- vertical. The breccia – metasediment contact is trending about 060° and is +/- vertical. Sub-horizontal fracturing in the breccia knob appears to be “post mineral” as there is no veining in the fractures. These sub-horizontal fractures are probably pressure release (un-weighting) fractures. This breccia body could be a pipe occurring at a structural intersection, or may be following a structure trending 060° (to MN), based on the wall rock contacts on the NW side.
Appendix 3

Compass Creek Rock Chip Assays

August 2009
<table>
<thead>
<tr>
<th>Sample No.</th>
<th>MGA Zone 52 (GDA94)</th>
<th>Au</th>
<th>Ag</th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Fe</th>
<th>Mn</th>
<th>P</th>
<th>Brief Description of Rock Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC-003</td>
<td>790212 8513980</td>
<td>0.001</td>
<td>0.6</td>
<td>38</td>
<td>444</td>
<td>69</td>
<td>358</td>
<td>10</td>
<td>1</td>
<td>6</td>
<td>1.9</td>
<td>78</td>
<td>Bull quartz vein (metamorphic), local patches of gossan</td>
</tr>
<tr>
<td>CC-004</td>
<td>790454 8515703</td>
<td>0.005</td>
<td>0.7</td>
<td>26</td>
<td>302</td>
<td>37</td>
<td>4660</td>
<td>84</td>
<td>70</td>
<td>36</td>
<td>18.2</td>
<td>869</td>
<td>KC - Sheared &amp; bxd altered metased w/ 10-50% FeOx bxwks</td>
</tr>
<tr>
<td>CC-005</td>
<td>790475 8515712</td>
<td>0.001</td>
<td>0.1</td>
<td>47</td>
<td>419</td>
<td>177</td>
<td>3560</td>
<td>4</td>
<td>42</td>
<td>43</td>
<td>18.0</td>
<td>645</td>
<td>1090KC - Shrd &amp; bxd altd metased w/ qtz vns &amp; 10-30% FeOx bxwks</td>
</tr>
<tr>
<td>CC-006</td>
<td>790477 8515681</td>
<td>0.001</td>
<td>0.1</td>
<td>34</td>
<td>54</td>
<td>22</td>
<td>1050</td>
<td>8</td>
<td>22</td>
<td>23</td>
<td>7.6</td>
<td>1510</td>
<td>450KC - Altered &amp; fractured metased w/ minor FeOx bxwks</td>
</tr>
<tr>
<td>CC-007</td>
<td>790499 8515693</td>
<td>0.014</td>
<td>1.1</td>
<td>53</td>
<td>103</td>
<td>24</td>
<td>7290</td>
<td>35</td>
<td>68</td>
<td>54</td>
<td>19.1</td>
<td>197</td>
<td>890KC - Qtz veined &amp; bxd altered metased w/ 10-70% FeOx bxwks</td>
</tr>
<tr>
<td>CC-008</td>
<td>790502 8515693</td>
<td>0.001</td>
<td>0.5</td>
<td>18</td>
<td>42</td>
<td>8</td>
<td>490</td>
<td>1</td>
<td>9</td>
<td>352</td>
<td>3.6</td>
<td>109</td>
<td>460KC - Sil-ser altd metased wallrock to bx, 1-3% diss FeOx casts</td>
</tr>
<tr>
<td>CC-009</td>
<td>790486 8515641</td>
<td>0.010</td>
<td>1.8</td>
<td>43</td>
<td>1070</td>
<td>19</td>
<td>1330</td>
<td>4</td>
<td>16</td>
<td>215</td>
<td>7.2</td>
<td>89</td>
<td>640KC - Bx w/ qtz vn matrix &amp; 40-60% FeOx bxwks, altd metased</td>
</tr>
<tr>
<td>CC-010</td>
<td>790471 8515663</td>
<td>0.001</td>
<td>0.1</td>
<td>17</td>
<td>59</td>
<td>24</td>
<td>839</td>
<td>1</td>
<td>26</td>
<td>272</td>
<td>10.0</td>
<td>431</td>
<td>560KC - Sil-ser altd metased, mod bxd, abun FeOx bxwks</td>
</tr>
<tr>
<td>CC-011</td>
<td>790276 8515474</td>
<td>0.069</td>
<td>2.4</td>
<td>34</td>
<td>1220</td>
<td>45</td>
<td>2000</td>
<td>17</td>
<td>27</td>
<td>100</td>
<td>5.2</td>
<td>123</td>
<td>270Qtz vn to SW of KC. Bull qtz, partially gossanous.</td>
</tr>
<tr>
<td>CC-012</td>
<td>789145 8513370</td>
<td>0.151</td>
<td>0.7</td>
<td>97</td>
<td>38</td>
<td>6</td>
<td>272</td>
<td>29</td>
<td>1</td>
<td>26</td>
<td>2.1</td>
<td>113</td>
<td>100Qtz sulphide vn float from Mavis mine area. 2 phases of qtz.</td>
</tr>
<tr>
<td>CC-013</td>
<td>789127 8516384</td>
<td>0.028</td>
<td>1.5</td>
<td>48</td>
<td>598</td>
<td>27</td>
<td>4580</td>
<td>44</td>
<td>77</td>
<td>190</td>
<td>16.7</td>
<td>49</td>
<td>1780JP - Bx/Vn - ground-up wall rock w/ qtz stringers, 5-20% FeOx</td>
</tr>
<tr>
<td>CC-014</td>
<td>789123 8516380</td>
<td>0.041</td>
<td>0.8</td>
<td>52</td>
<td>593</td>
<td>9</td>
<td>1380</td>
<td>23</td>
<td>32</td>
<td>279</td>
<td>10.8</td>
<td>59</td>
<td>2210JP - Bx/Vn float, str altd metased wall rock, 30-60% FeOx bxwks</td>
</tr>
<tr>
<td>CC-015</td>
<td>789132 8516362</td>
<td>0.076</td>
<td>0.8</td>
<td>71</td>
<td>433</td>
<td>70</td>
<td>3980</td>
<td>16</td>
<td>461</td>
<td>66</td>
<td>8.7</td>
<td>71</td>
<td>720JP - Top of hill, no bx, just altd &amp; fracd metased, tr qtz vn &amp; FeOx</td>
</tr>
<tr>
<td>CC-016</td>
<td>789150 8516338</td>
<td>0.061</td>
<td>4.7</td>
<td>20</td>
<td>1.64%</td>
<td>39</td>
<td>1430</td>
<td>8</td>
<td>288</td>
<td>7290</td>
<td>3.8</td>
<td>69</td>
<td>4060JP - Bx/Vn (sim CC-013), sil-ser altd metased, vuggy &amp; FeOx</td>
</tr>
<tr>
<td>CC-017</td>
<td>789105 8516386</td>
<td>0.187</td>
<td>1.2</td>
<td>74</td>
<td>1630</td>
<td>77</td>
<td>4650</td>
<td>72</td>
<td>370</td>
<td>95</td>
<td>11.0</td>
<td>76</td>
<td>1460JP - Large bx knob, sil-ser altn, abun qtz vns. Could be a pipe.</td>
</tr>
</tbody>
</table>

Note:
- Au assay of <0.005 are shown as 0.001 ppm, and Ag assays of <0.5 are shown as 0.1 ppm
- Assays by ALS Chemex in Brisbane: Au by AA24, Sn by ME-XRF05, Pb% by OG62, and the remainder by ME-ICP61
- KC = Kamas Cauldron, JP = Jasons Peak
- 23 other elements were analysed, but were not included in this table as the values were considered to be within background ranges.
- These other 23 elements are: Al, Ba, Be, Ca, Cd, Co, Cr, Ga, K, La, Mg, Mo, Na, Ni, S, Sc, Sr, Th, Ti, U, V & W
Appendix 4: Photos from Compass Creek (August 2009)

Photo 1: Kamas Cauldron: showing phyllic/silicic altered wallrock (metasediment) on NW edge of hill. Site of rock sample CC-004 is just to right of this photo.

Photo 2: Kamas Cauldron: altered & gossanous breccia with local quartz veining. Sub/otc & float near northern end of hill. Site of rock sample CC-005.
Photo 3: Kamas Cauldron: Gossanous breccia outcrop & float (right) and silicie to phyllic altered wallrock (metasediment) to the left, on the east side of the hill. Site of rock samples CC-007 (breccia) & CC-008 (altered metasediment wallrock to breccia).

Photo 4: Kamas Cauldron: Gossanous breccia outcrop with local quartz veining, on east side of hill. Site of rock sample CC-007.
Photo 5: Kamas Cauldron: Sub otc & float of gossanous breccia (to left) and outcrop of silicic/phylllic altered wallrock on right. On the SW side of hill and site of sample CC-009.

Photo 6: Kamas Cauldron: Gossanous & quartz veined breccia (close up of above photo). Site of rock sample CC-009.
**Photo 7:** Jason’s Peak: south-east end (centre of photo looking $300^\circ$ to MN).

**Photo 8:** Jason’s Peak: Breccia-vein structure with ground-up wall rock and local quartz stringers. Structure trends $010^\circ$ to MN and is 0.5m to 1.0m wide. Site of sample CC-013.
Photo 9: Taken from Jason’s Peak (at the above photo and rock sample site CC-013), looking NNE to a hill of possible altered and iron stained material.

Photo 10: Jason’s Peak: Altered metasediment (silicic/phylllic) with large voids (ex porphyroblasts) and local breccia and gossanous float – sub/otc. Site of rock sample CC-014, near north-west end of ridge.
**Photo 11:** Jason’s Peak: Centre and top of ridge. Phyllic-chloritic altered metasediment with local quartz-limonite veining and narrow breccia veins. Site of rock sample CC-015. No major veins exposed in this area.

**Photo 12:** Jason’s Peak: breccia vein (1m wide) trending 015° to MN, in vuggy porous altered metasediment with common quartz veins and yellow-brown limonite. Located on the south-east end of the ridge; site of rock sample CC-016.
Photo 13: Jason’s Peak: breccia knob on north-west end of ridge. Breccia possibly formed at the junction of two faults, or in a dilation zone in a NW trending fault. Bedding on NW side is near vertical. Sub-horizontal fractures are post mineral un-weighting fractures. Site of rock sample CC-017.

Photo 14: Jason’s Peak: NW side of breccia knob. Note quartz veinlets cutting breccia at shallow angle, and the near vertical bedding on left (NW) edge of this photo.
**Photo 15:** Jason’s Peak: broader view of the breccia knob; possibly looking along a fault trend (060° to MN). Note again bedding on left edge and quartz veinlets at shallow angle.

**Photo 16:** Jason’s Peak: looking southerly. The breccia knob is located at the right edge of photo (westerly).
Appendix 5

Macro Rock Chip Photographs

August 2009
Appendix 5: Macro Photos of Compass Creek Rock Samples

Samples collected in August 2009 during a reconnaissance field trip by Dave Bennett and Jim McGregor-Dawson.

CC-003: SE Qtr of the tenement. Metamorphic “bull quartz vein” with local boxworks after sulphides. Wall rock (Burrell Ck Fm) has been moderately chloritized.

CC-004: Kamas Cauldron: Sheared and broken (brecciated) metasediment altered to sericite and quartz with abundant boxworks/vughs (10-50%) after pyrite and other sulphide minerals. Occasional thin quartz veins (hl to 5mm) are present.
CC-005: Kamas Cauldron: Float pieces consist of broken and brecciated, foliated (& sheared) metasediment with abundant quartz veining and iron oxide boxworks (10-30%) and iron flooding (trace specular hematite?).

CC-006: Kamas Cauldron: Central part of hill. Altered metasediment (greywacke?), which is now medium-grained sericite (quartz) schist with iron staining around fractures with occasional iron oxide boxworks along fractures.
CC-007: Kamas Cauldron: Brecciated rock and quartz vein material with abundant medium to coarse grained iron oxide boxworks (10-70%). Cubic pyrite casts are obvious and other sulphide minerals are likely present. The fragments of rock are metasediment altered to fine grained sericite (& quartz), and stained yellow-brown by limonite (FeOx).

CC-008: Kamas Cauldron: Silicified and sericitised (& chloritized?) metasediment (greywacke?). The alteration has destroyed (masked) the metamorphic foliation. About 1-3% disseminated iron oxide occurs in fine to coarse grained cubic to rounded casts (0.1-0.5cm) after porphyryoblasts of mafic minerals (replaced by pyrite and chlorite etc.). This rock forms the outer rim around the top of the hill and is the wall rock to the breccia.
CC-009: Kamas Cauldron: Breccia with quartz matrix carrying 40-60% medium grained iron oxide casts of sulphides (including cubic [pyrite] casts) and limonite coatings and filling voids. Occasional metasediment fragments that are strongly phyllic altered with up to 30% disseminated sulphide boxworks. Quartz veinlets also cut the breccia matrix.

CC-010: Kamas Cauldron: Variety of float from centre of the hill. All sample pieces consist of strongly altered (phylllic?) metasediment with abundant disseminated iron oxide boxworks and clusters after pyrite and possible mafic minerals (similar to the altered rim rock). Quartz-gossan veining is common, with silica-sericite material occurring locally as layers.
CC-011: Located just SW of Kamas Cauldron: The quartz vein zone is about 5m wide and trends 290° to MN, with the largest individual vein being about 1m wide. The veins are white (bull) quartz with local gossan zones. Part of the sample also contains some weak to moderate chlorite altered metasediment wall-rock.

CC-012: Mavis Tin Mine: Various float or mine dump material consisting of two phases of partly gossanous quartz veins. Early coarse grained white (bull) quartz which has been broken and cut by a later pale grey medium to coarse grained quartz which often has open vughs, often filled with orange-brown clayey material, and locally iron oxide material.
CC-013: Jason’s Peak: Fault/vein material made up of brecciated and comminuted wall rock (clay) with stringer quartz veins (<5cm) and veinlets throughout, and local silification. FeOx casts (ex sulphides?) are also present. Wall rock consists of silicified and sericitised metasediments with 5-20% iron oxide lined vughs after mafic minerals and pyrite.

CC-014: Jason’s Peak: Breccia vein material of strongly phyllic altered wall rock with 30-60% iron oxide lined and spongy (gossan) vughs up to 2cm diameter. Voids often have secondary minerals growing in them.
CC-015: Jason’s Peak: Relatively massive wall rock material consisting of phyllic altered metasediment with cubic to rounded voids (2-10mm). The voids probably represent hornfels mafic porphyroblasts, later replaced by chlorite/pyrite during hydrothermal alteration.

CC-016: Jason’s Peak: Vuggy breccia vein (~1m) with quartz veins (up to 2-3cm) and fragments of variably altered metasediment (clay-sericite-silica). Cubic voids close to quartz veins appear to be ex-pyrite, while larger cubic and rounded voids in the metasediment are probably altered porphyroblasts after mafics now altered to clay, chlorite and pyrite.
**CC-017**: Jason’s Peak: Small breccia pipe consisting of phyllic to silicified metasediment fragments cut by many quartz veins and veinlets, and filling breccia voids. Quartz veins commonly contain iron oxide boxworks and clusters after sulphides, while metasediment fragments have large cubic to circular voids (ex altered mafic porphyroblasts). Breccia matrix also has orange-brown clayey material (ex gouge?) with irregular quartz veinlets through it.
Appendix 6

Compass Creek

Tempest Airborne Electro-Magnetic Survey

Review by David McInnes

Oct 2009
A review of the Tempest Airborne Electro-Magnetic (AEM) data collected over the Compass Creek Exploration License (EL25399) on behalf of Hapsberg and GA, by Fugro Airborne Surveys (FAS) in November 2008, has been completed. FAS flew 34 traverses over the Compass Creek Exploration License (figure 1a). This data was collected as part of a more regional survey contracted by Geoscience Australia (FAS Job #2017 GA project # 1196). The regional survey was collected with a line spacing of approximately 1.6 km and the Hapsberg detailed data with a flight line spacing of approximately 240m (figure 1b).
The detailed and regional data were integrated as part of the review. Fugro Airborne Surveys have calculated Conductivity Depth Images for all the "X" component data. From these; two anomalous areas of mildly elevated conductivity (figure 2a and 2b) are identified within Hapsberg’s Compass Creek EL: Although in a regional context these anomalous areas are not highly conductive (figures 3a and 3b). However the conductive zones may represent lithologies with a higher carbon content, hence being a good reducer for oxidised fluids carrying uranium.

The conductive zones have also been considered in relationship to the other available open file data sets (Magnetics and Radiometrics - note the gravity coverage is relatively poor for the area). In the magnetic data the southern conductive zone strikes in the same orientation as the regional magnetic trend (NNW), with the northern extension of the conductor apparently truncated/terminated by a semi-regional NE striking structure. The northern conductor strikes in a NE orientation, and in the filtered magnetic images it appears to be within a structure where its southern extension is terminated by a NW striking structure (figure 4).

The Radiometric Images show that to the south-west of the conductors there is a radiogenic granite (good source). The Northern anomaly is coincident with a Thorium anomaly and there is a subtle zone of elevated Uranium to the NW (up-dip location?). The southern conductor zone is associated with a subtle Uranium anomaly, as best demonstrated in the RGB image (figure 5).
Figure 2a: Conductivity Depth Slice, 150 to 200m. The conductors are clearly displayed.

Figure 3a: Conductivity Depth Slice, 150 to 200m. The conductors in the Compass Creek are displayed in context with the more regional conductors.
Figure 2b: Stacked Display of Conductivity Depth Images for the detailed Tempest data over the Compass Creek Exploration License.
Figure 3b: Stacked Display of Conductivity Depth Images for the regional Tempest data.
Figure 4: Stacked Magnetic images, with the interpreted conductors overlain.

Figure 5: Stacked Radiometric images, with the interpreted conductors overlain.
TEMPEST BACKGROUND INFORMATION

The logistical report, as supplied by Geoscience Australia, outlines the data collection system and survey specific information. However in summary the Tempest system is a time domain electromagnetic system operating with an out of loop (slingram) configuration. It has two receiving antennas recording a “Z” and “X” component. These record the decay of the magnetic field induced in the ground by a time varying current that is passed through the transmitter loop. The rate of change (decay) of the magnetic field is directly related to the resistivity of the ground below the transmitter loop/plane. The receivers are in a bird which trails the aeroplane approximately 30m below and 120m behind.

The transmitter loop consists of six turns/loops around the wingtips, nose and tail of the plane and the transmitter operates at 25hertz with a 50% duty cycle square wave; 10msec on-time pulse and a 10msec off-time. The receiver coils within the bird record the rate of change of the magnetic field with respect to time (dB/dt). The final data as supplied by Fugro is transformed from dB/dt to magnetic field data (“B” field).

The Electromagnetic method responds to conductors such as the cover sequences due to the significant electrical contrast between the younger overlying unconsolidated sediments (conductors) and the crystalline basement units (resistors). It detects massive sulphides within the crystalline basement as currents are induced in these discrete more conductive zones. It is also sensitive to faults within the lower crystalline basement as they are generally better conductors due to:

- The shearing that occurs along the fault plane, generally developing more platy better interconnect minerals.
- The increased conductivity of the minerals developed within the shear (clays/graphite)
- The generally higher water content within the fault plane
- And the increased porosity/permeability within the fault plane.

All of the above improves the electrical interconnectivity of the fault plane decreasing its resistivity in contrast to the more resistive crystalline basement.

From the observed data Conductivity Depth Images (CDIs) can be calculated. These CDIs are a point transform of the observed AEM data at a specific time down the electromagnetic decay and from these electrical cross section models can be constructed. These display the thickness of the overlying sediments/unconformity and the crystalline basement contact can also any conductive structures that are contained within the basement will be detected due to their decreased resistivity as previously explained above (discrete massive sulphides and faults).

The two receiver components a more sensitive to different geological features. The "Z" component data is generally better at mapping a horizontal conductor, such as the unconformable surface (figure 6a). The "X" component is more responsive to vertical conductors such as those that might be sourced by faults or thin massive sulphide deposits (figure 6b). Due to a better system geometry the "Z" component tends to have lower noise thresholds than the "X" component data.
Figure 6a: Slide demonstrating the coupling properties of the "Z" component data.

Figure 6b: Slide demonstrating the coupling properties of the "X" component data.