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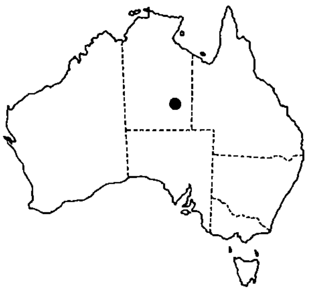

Molyhil Scheelite-Molybdenite Deposit

by M.J. Freeman[1]

INTRODUCTION

The Molyhil deposit is located 240 km NE of Alice Springs (320 km by road), at lat. 22°45′S, long. 135°45′E, on the Huckitta (SF 53–11) 1:250 000 and Jinka (6052) 1:100 000 scale maps, Northern Territory.

From an assessment of drill hole data, Petrocarb Exploration NL (Petrocarb) (1983) determined indicated open cut reserves of 1.8 Mt at 0.6% WO_3 and 0.3% MoS_2. Calculations are based on percussion drill hole sampling, and mining experience indicates that these drill estimated grades are likely to be low, with production figures up to 0.5% higher (combined WO_3 + MoS_2).

EXPLORATION HISTORY

Widespread scheelite mineralisation had previously been located in the Bonya Hills some 40 km east of Molyhil (Warren, Stewart, and Shaw, 1975). Prospecting using UV lamps in 1973 located scheelite in layered calc-silicate rock at the Molyhil Pinnacle, from which some 20 t of scheelite were selectively mined by Fama Mines Pty. Ltd. Subsequently scheelite was located 800 m east of the Pinnacle and this deposit, termed the Yacht Club orebody, produced 20 000 t of ore which yielded 100 t of concentrate at 70% WO_3 to 1976 (Barraclough, 1979).

After completing a preliminary drilling program, Fama Mines received assistance from the Northern Territory Department of Mines and Energy who conducted geological mapping, a ground magnetic survey, and finally drilled eight cored holes totalling 740 m. Assessment of the data indicated the presence of a new *Southern* orebody containing molybdenite in addition to scheelite. Petrocarb acquired the leases in 1978, upgraded the mining and processing plant and completed a 20 hole 2100 m percussion drilling programme in 1981. Mining ceased in 1982 and the leases were then placed on a care and maintenance basis.

REGIONAL GEOLOGY

Molyhil occurs within the Arunta Orogen, a 250 000 km^2 area of polydeformed crystalline rocks. The orogen originated as a sequence of sediments and volcaniclastics within the period 2400 to 2000 Myr (Stewart, Shaw and Black, 1984). The orogen was widely metamorphosed at 1800 Myr and parts at 1700 to 1600 Myr, 1500 to 1400 Myr and 1100 to 900 Myr. Granites were intruded at 1800 Myr, 1700 to 1600 Myr and 1400 Myr. Dynamometamorphism then followed in the Alice Springs Orogeny at 350 to 300 Myr (Shaw, Stewart and Black, 1984). During this orogeny, major dislocation zones were remobilised with WNW and NW trends. One such zone, the Delny–Mount Sainthill fault zone (Warren, 1978), lies immediately to the south of Molyhil, with NW trending splays occurring north of the prospect. This zone is a major crustal break and the rocks on either side have little relation to each other (Shaw et al., 1984).

Georgina Basin sediments accumulated over Molyhil during the Adelaidean and Palaeozoic eras. Erosion has since removed most of these sediments in the Molyhil vicinity except for two hills about 1 km south, and a ridge about 0.5 km north, where they are preserved in down faulted slices within the fault zone and in a splay fault bounded block respectively.

MINE AREA GEOLOGY

The mineralisation occurs within layered calc-silicate rock and skarn in rafts of metasediment, tentatively assigned to an undefined rock unit (Freeman, 1986) within granite.

Two granites are recognised at Molyhil; the Jinka Granite to the north and the Marshall Granite elsewhere around Molyhil. The Jinka Granite is an even grained, pink, biotite granite with rare phenocrysts of potassium feldspar. The Marshall Granite is a pink, slightly foliated, hornblende granite to leucogranite in which retrograde alteration of the hornblende to biotite is common (Shaw et al., 1984), perthite is present and microcline is partly altered to white mica (Morgan, 1959). The granite in the open cut is considered to be a variety of the Marshall Granite (Shaw et al., 1984). Dating of the Jinka Granite gave 1440 Myr by the K-Ar method (Hurley et al., 1961), and 1785 Myr by the Rb-Sr method on muscovite (Wilson et al., 1960). It is believed that the granite was emplaced at the earlier date and was subsequently slightly metamorphosed at about 1440 Myr. The Marshall Granite has not been dated.

OPEN CUT GEOLOGY AND MINERALISATION

Four main rock types occur at Molyhil: calc-silicate, exoskarn, endoskarn and granite.

The layered **calc-silicate** rock consists of clinopyroxene, epidote or garnet bearing marble layers from 10 to 40 mm thick, with interlayered grossular-pyroxene gneiss, epidote bearing quartzite and medium grained quartzofeldspathic gneiss.

The **exoskarn** was divided into mineralised and unmineralised types by Barraclough (1979). He noted that the mineralised rock is more iron rich than the unmineralised type and is a hornfels consisting of andradite, actinolite, ferrohastingsite, diopside, scapolite, potassium feldspar, plagioclase, quartz, epidote, tremolite, calcite and magnetite, with lesser pyrite, and trace quantities of scheelite, molybdenite, chalcopyrite and galena. Allanite occurs with fluorite and barite in small discordant late stage quartz rich veins to 20 cm wide, and fluorite replaces feldspar (D.G. Morris, personal communication). Unmineralised exoskarn consists of poorly interlayered grossular-andradite-quartz-biotite-epi-

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dote-diopside hornfels and diopside-quartz-biotite-epidote-andradite hornfels, neither containing much magnetite, scheelite, molydenite, pyrite or chalcopyrite. Scheelite and grossular appear to be mutually exclusive. Barraclough (1979) demonstrated that the exoskarn contained a consistent layered sequence on a 0.5 to 8 m scale.

Endoskarn, which is metasomatised Marshall Granite, contains pink microcline, quartz, grey biotite, actinolite, pyroxene and traces of magnetite, pyrite, scheelite and molybdenite. The rock ranges from a deep pink to pinkish grey and locally is very coarse grained, with actinolite crystals to 0.5 m long and 60 mm across.

Compositional layering exposed in the open cut dips at 80° E. The Yacht Club orebody has a strike length of 50 m, a horizontal width of 20 m and has been intersected in drill holes to a depth of 112 m. The Southern orebody has a strike length of 110 m, an average width of 30 m and extends to at least 160 m depth. The two orebodies are separated at a shallow depth by a granite sheet containing a possible fault, which is a 3 m wide brecciated zone dipping 50° S and which is infilled with quartz, calcite, fluorite and barite. The Yacht Club orebody is 40 m east of the Southern orebody near ground level, although drilling indicates that both merge at depth. The mineralisation plunges at 65° S (Fig. 1).

Scheelite is distributed erratically, but the greatest concentrations are seen to occur in the magnetite rich andradite bearing hornfels with some layers containing 70% $CaWO_4$ by volume. Scheelite is anhedral to subhedral with grain size to 20 mm. The scheelite fluorescence is white to very pale yellow, indicating that over 1% powellite ($CaMoO_4$) is present (Gleason, 1972, p. 176). Aggregates of scheelite to a depth of 10 m are zoned with a yellow fluorescing rim and a blue-white fluorescing core, interpreted by Barraclough (1979) as having been produced by supergene enrichment. Ferberite ($FeWO_4$) occurs in the supergene zone. Molybdenite occurs mostly as dispersed crystals or rosettes to 8 cm across, and layered concentrations, in contrast to the scheelite, are rare.

Little statistical geochemical data is available on the ore metal distribution. The scheelite concentration correlates with the proportion of iron as oxide, sulphide and silicate and the highest grades occur in a magnetite-pyrite rich zone 30 m from the hanging wall granite. Petrocarb (1981) noted molybdenum enrichment at the extremities of the orebody.

ORE GENESIS

The mineralisation occurs within severely altered calcareous metasediments surrounded by granite. H.W. Fander (unpublished data, 1977) considered that the sediments were initially contact metamorphosed by the intrusive. Metasomatism then followed, with an acid fluid phase from the magma containing silica, alkali metals, halides, sulphur, tungsten, molybdenum, iron and copper which reacted with the metamorphosed rock to produce garnet, scapolite, microcline, molybdenite and scheelite.

Metasomatism by more iron rich fluids then followed with production of actinolite, epidote, ferrohastingsite, allanite, pyrite and magnetite. Finally fluorite, barite, quartz and calcite were deposited in fault breccias and as veins.

EXPLORATION POTENTIAL

Widespread prospecting using UV lamps has located only minor additional scheelite near Molyhil. Geopeko managed a joint venture with Petrocarb during the period 1982 to 1983 which prospected an area of some 900 km^2 for Molyhil type mineralisation. A detailed aeromagnetic survey was completed (Turley, 1983) and several magnetic anomalies were located which were found, by percussion drilling, to contain weak mineralisation. It is considered that further exploration using the existing data is warranted.

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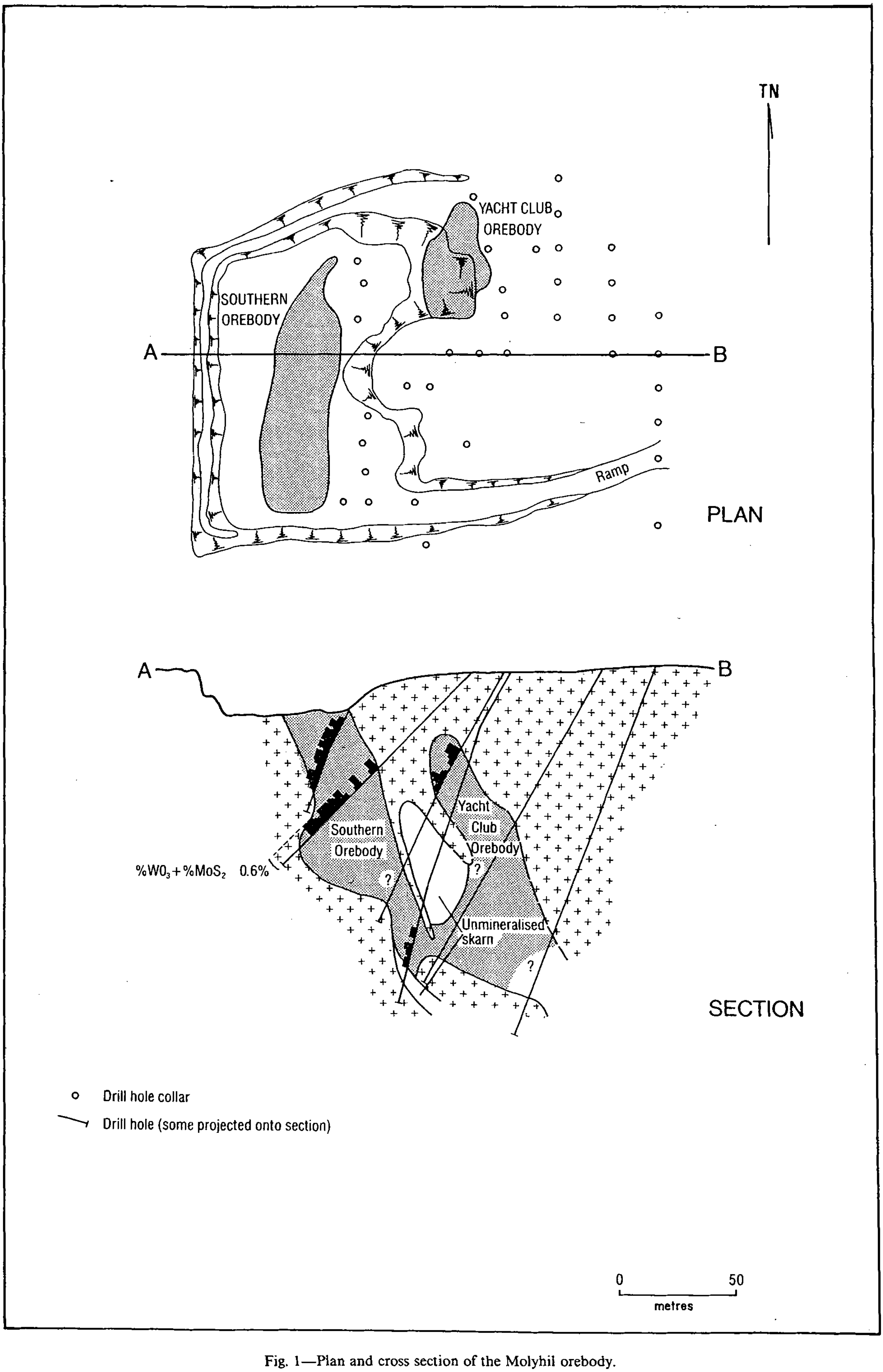

Fig. 1—Plan and cross section of the Molyhil orebody.