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GEOLOGY OF THE PEAKS-NARRI AREA, COBAR DISTRICT.

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by

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With an Appendix by C.J. Sullivan.

INTRODUCTION.

The investigation which is the subject of this report was based on previous work in the Cobar Area by the Bureau of Mineral Resources and the New South Wales Mines Department. In report No. 1947/74 Mr. C.J. Sullivan reached the conclusion that the discordant contact between slaty and sandy beds in the New Cobar-Chesney-New Occidental Area was a feature of major importance in ore localisation. Accordingly Messrs. C.J. Sullivan, B.P. Walpole and G.F. Joklik proceeded to Cobar for the purpose of investigating and mapping the discordant contact south from the New Occidental Mine, to determine whether a relationship existed between the discordant contact and ore formation in that area and to commence a detailed geological map on a regional scale of the Cobar-Nymagee mineral belt.

The party arrived in Cobar on 31st December, 1947, and detailed mapping was commenced using the Peaks Area, four miles south of Cobar as a starting point and working southwards and westwards towards the general line made by the escarpments running through Coronation, Beechworth and Queen Bee Narri prominences. With the departure of Mr. Sullivan from the Cobar Area on 21st January, 1948, the work was continued by Messrs. Walpole and Joklik until 20th February, 1948.

Grateful acknowledgement is made to Mr. E. Brees and the staff maintained at Cobar by Zinc Corporation Ltd., for their whole-hearted co-operation and the loan of aerial photographs and parish maps.

GENERAL GEOLOGY.

It was ascertained that the discordant contact is a regional feature and swings in a general easterly direction from the Peaks Area towards the Coronation-Beechworth escarpment (approximately one and three quarter miles to the east), finally joining this line in the immediate northerly vicinity of the main Coronation shaft. From here it was traced southwards to the vicinity of Narri Trig approximately eighteen miles south of Cobar in a directline. A reconnaissance was carried out over a distance of approximately ten miles south from Narri Trig with the object of determining whether the discordant contact still continued in a southerly direction. This area was not mapped but it was ascertained that a contact still existed and appeared to continue even farther southward. The presence of numbers of buck quartz reefs and areas similar in lithology to those farther north would seem to warrant closer investigation.

Earlier maps on a regional scale of the Cobar area, with the exception of an accurate and informative map by Mr. E. C. Andrews (1911) contain very little information and no previous work had been done on the concept of the association of mineralisation with a discordant contact, with the exception of that mentioned in Mr. Sullivan's report on the New Occidental Area.

Mapping was carried out by plotting direct on to enlarged aerial photographs on a scale of 420 feet to the inch and in the Narri area on smaller prints with a scale of 1350 feet to the inch. Difficulty was encountered with the smaller prints as exact localities were hard to distinguish on such a scale and it is suggested that, if this method of mapping is to be used in the future, enlarged prints of the whole area be obtained. The areas mapped were first reconnoitred thoroughly by jeep and the

actual mapping done on foot. Individual trees, creeks, tracks, old shafts and pits, costeans etc., were used for accurately locating positions on the photographs. Although this area was photographed over ten years ago, the vegetation has altered very little and the enlarged prints provide an excellent medium for detailed mapping. The aerial photographs are not in a continuous sequence, there being a gap of some miles in the area immediately south of Narri Trig. Much of this latter area is held under lease by North Broken Hill Co., Limited.

Detailed mapping was first carried out on the enlarged prints and the information then transferred to the smaller scale prints. These were then made up into a form of mosaic and the actual map traced from them. Tracings were also done of the enlarged prints to allow reference to specific areas for more detailed information.

It is suggested that, owing to the nature of the country and the wide area to be covered, mapping by plane table or other similar methods would be too tedious and that the most practicable method is that used in the area north of Narri Trig Station i.e. on <u>enlarged</u> aerial photographs.

With the exception of two minor intrusions of quartz felspar porphyry, the lithology of the area studied consists entirely of sediments. The rocks are Silurian in age and are overlain to the west by thick Devonian sediments. The beds consist of slate, argillaceous, medium-grained and coarse-grained sandstone and conglomerate. The conglomerate is very coarse and made up of waterworn and elongated quartzite pebbles. On the surface the cementing material has been weathered away.

A petrological investigation of the New Occidental-Chesney-Fort Bourke area carried out by Mr. W. Dallwitz of the Bureau of Mineral Resources, established that many of the sandy and slaty rock types were tuffaceous in character. Coarse crystalline tuff outcrops in the Narri Area.

Metamorphism of the finer grained sedimentary beds belonging to the footwall or western side of the discordant contact, is on a regional scale. The beds of the hangingwall ore eastern side are generally coarser in grain and do not appear to have been subjected to as great a degree of metamorphism as those of the footwall side and this would suggest that the slate and sandstone of the footwall are the older rocks. Cleavage is well developed in the finer-grained beds of both sides of the contact. This cleavage is very highly developed in the slate of the footwall and to a lesser extent in the shale and argillaceous sandstone of the hangingwall. Medium-grained sandstone in the Queen Bee Area nine miles in a direct line south-east from Cobar also shows well developed cleavage. Both hangingwall and footwall beds dip in towards the contact but their strikes are not always parallel to it. This is the case with the hangingwall series in particular. The pitch of the bedding roughly approximates the pitch of folding and varies from 10 degrees in the Peaks Area to 85 degrees in the vicinity of the Queen Bee and is in a southerly direction with the exception of one or two areas of localized minor contortion. Dip is normally steep in both instances and ranges from 40 to 85 degrees.

The terms "footwall" and "hangingwall" are used to avoid confusion with earlier reports. The terms originated from the original concept that the discordant contact in the New Occidental-Fort Bourke-Chesney Area was a fault of wide displacement. "Footwall", as used in this report, refers to those beds on the western side of the discordant contact, and "hangingwall" to those on the eastern side.

CHARACTER OF THE DISCORDANT CONTACT.

The contact swings in a wide and well defined arc from the Peaks Area across to the Coronation-Beechworth line, but is not marked by any special topographical features over this area. It can, however, be traced by the lithology of the beds on either side of it, these consisting of fine-grained well cleaved slates in the footwall and medium-grained to argillaceous, tuffaceous and sandy beds in the hangingwall. The footwall beds dip in towards the contact at approximately 80 degrees, but owing to the character of the rocks, accurate bedding readings are difficult to find. Weathering effects often give a false impression and metamorphism has destroyed most of the original bedding planes. The coarser hangingwall rocks, however, allow more accurate structural determinations to be made. These also dip in towards the contact, at from 60 to 70 degrees and the folding pitches in a southerly direction. The pitch of these beds in the Peaks Area varies from 10 to 40 degrees. (See Photo 11888, Run 6).

In the immediate eastern vicinity of the main Peak mines shaft the contact steps sharply to the east going south. Whether or not this "bend" is in itself contorted cannot be ascertained from the surface as a covering of alluvium obscures the area. The presence of proved orebodies on the north-western extremity and to the west of the "bend", together with the conclusions drawn by Mr. Sullivan in his report, suggested careful examination of this particular area and the results of this examination will be detailed fully under Economic Geology.

From the Coronation shaft area the contact extends in a south-easterly direction along the line of a well defined escarpment. The footwall rocks consist in the main of slate, slightly coarser in grain than those to the east, and they have been subjected to shearing. Mineralization is very pronounced in the form of iron and manganese-stained quartz veinlets replacing the slate along the cleavage planes. The general pitch of the beds is southerly and they dip in an easterly direction at approximately 75 degrees. Numerous old shafts are present in this area, some of which struck payable ore.

The hangingwall rocks consist of interbedded argillaceous sandstone, thin lenses of yellow slate and coarser tuff. The sandstone along the edge of the contact has been sheared to some extent. All three rock types show distinct cleavage. The zone of shearing extends southwards to the vicinity of the Beechworth Shaft and the shears themselves are not parallel to the contact. (See Photo. 12449, Run 9).

From the Beechworth shaft the contact continues in an approximately straight line in a south-easterly direction to the area of the Central Shaft. Along this line the topography of an undulating character and the contact is marked by mineralization in the form of quartz veining running parallel with it along the actual contact and to the east and west. Most of this quartz veining is of a minor character and consists of buck quartz surrounded by scattered quartz float.

From the Central Shaft the contact swings gradually to the westward and away from the line of the Queen Bee escarpment. It then continues in a roughly parallel direction, but about three quarters of a mile to the west of the escarpment. Here the lithological difference between the footwall and hangingwall beds is not so well marked. Beds of slate and sandstone make up the footwall rock whilst interbedded argillaceous sandstone, slate and tuff form the hangingwall. Accurate dip and strike readings are extremely difficult to obtain and, as much of the area is covered by alluvium and conglomerate wash, the actual position of the contact for some distance can only be approximately determined.

Mineralisation in this area is again extensive but it is interesting to note that it is much more marked to the east of the contact, i.e. in the hangingwall, and indeed appears to follow the general line of the contact between a bed of medium-grained sandstone and slate swinging away to the east and finally joining up with the Queen Bee escarpment to the north of the Queen Bee Mine. It was/first thought that this low sandstone ridge marked /at the actual discordant contact, but an investigation of beds of argillaceous and tuffaceous sandstone exposed in a watercourse crossing the old Illewong Road (See Photo 1244, Run 9), farther to the west showed thatthis was not the case. From these beds some excellent dip and strike readings were obtained. The strike of the beds was found to be north-west and the dip to the south-west at 85 degrees. The pitch of the beds is southerly and very steep (approximately 85 degrees).

It is also of interest to note that the Queen Bee lode does not follow the pattern of the New Occidental, Fort Bourke and Chesney lodes. It is located to the east of the discordant contact in a locally contorted and sheared area along the boundary of a formation of medium-grained sandstone containing a few rounded and stretched quartzite pebbles and beds of interbedded yellow slate, argillaceous sandstone and tuff.

The discordant contact in this area skirts the eastern limits of the old Illewong township and then swings to the west and appears to rejoin and continue south along the eastern margin of the Queen Bee escarpment. The topography in this area is mostly flat to the west of the escarpment. The surface is covered for the greater part by alluvium and for this reason the actual line taken by the contact can only be indicated approximately. However, on lithological evidence and the few dip readings obtained in this vicinity, it is reasonable to assume that there is a "step over" to the west in a manner similar to that of the Peak "bend" but on a larger scale. This "bend" may also in some manner account for the formation of the Queen Bee lode, the presence of which has always been a problem that has not yet been satisfactorily explained.

The evidence presented by this area, although not as definite, presents a parallel with that of the Peak and would seem to warrant a closer investigation by geophysical methods.

In a general southerly direction from the Illewong area, the contact approximately follows the line of the escarpment running towards Narri for a distance of two to three miles. However, the lack of opportunities for making accurate dip and strike determinations allows only a lithological determination of the contact and its actual position from the region of the quartz felspar porphyry outcrops (two miles south of the Queen Bee) southwards, can only be assumed.

The presence of thick beds of conglomerate in an area approximately four miles due south of the Queen Bee and a mile and a half westwards from the escarpment, together with mineralisation in the form of large limonitic gossans and quartz lodes in the same general line and about three miles due west of Narri Trig would seem to indicate that the Narri escarpment does not wholly form the hangingwall of the discordant contact. That this concept is a distinct possibility is quite probable as a parallel could be drawn with the Queen Bee area. The contact itself is not always a junction between fine-grained and coarse-grained rock. This is a most important point and does not necessarily mean that an area, in which the lithology of the footwall and hangingwall beds were similar, would not lend itself to ore deposition. Juxtaposition of fine beds along the contact is as common as is that of competent and incompetent beds and occurs in areas where proved orebodies are present.

Although a difficult feature to trace, and even though in some areas it seems to disappear completely, it is reasonably certain that the discordant contact is a regional feature which is intimately related to ore deposition. Its continuance for many miles south of the Queen Bee has been established but its exact location in the area surrounding Narri Trig and to the south will require much more closer investigation.

STRATIGRAPHY.

The rocks in the area between the Peaks and Narri Trig are Silurian in age and are overlain to the west by a thick series of Devonian sediments which consist in the main of quartzite and sandstone. As the general stratigraphy of the Cobar area has been described at length by previous workers, this chapter will deal exclusively with that encountered in the area between the Peaks and Narri Trig. That the beds in this area, which make up part of the Cobar series so named by Mr. E.C. Andrews, are of Silurian age is borne out by the discovery during the present investigation of a coral (Favosites) of Silurian age in the finer-grained hangingwall rocks of the Queen Bee area.

The general topography of the area consists of flat plains covered by stunted scrub to the north and patches of dense cypress pine vegetation to the south with occasional low ridges of slate and sandstone. To the east the area is bounded by the escarpment following the general line of the Coronation-Beechworth and Queen Bee-Narri prominences which form the eastern limit reached by the numerous creeks which traverse the plain country lying to the westward. By far the greater part of the area is of low relief and masked by thick alluvium which in many places contains unconsolidated conglomerate-wash up to four or five feet thick. Outcropping beds on the low ridges are often weathered and broken up into slate or sandstone float.

The rocks of the footwall consist of an almost continuous and very thick series of slate, varying in colour from yellow to red to brown and often tuffaceous in character. The brown slate is often micaceous and is characteristic of the footwall in the Queen Bee area. Occasional thin lenses of sandstone and tuffaceous sandstone occur. The slate is in the main highly cleaved, the cleavage traces trending 160 degrees E of N to 125 degrees E of N.

The best exposures are found in creek beds which are often deep enough to have removed the alluvial covering. These creeks or dry watercourses are very numerous and also serve as a means of orientation in the field when mapping on aerial photographs.

The hangingwall rock types are more diversified than those of the footwall and consist of tuffaceous sandstone, fine to coarse-grained non-tuffaceous sandstone, grit, conglomerate, yellow slate and crystalline tuff. Two outcrops of quartz felspar porphyry also occur to the south of the Queen Bee Mine.

Tuffaceous sandstone and sandy beds of medium grainsize form the hangingwall of the discordant contact from the region of the Peaks area eastward to Coronation-Beechworth area. Southward from here the main mass of hangingwall rock is made up of interbedded argillaceous to medium-grained sandstone and tuff with some thin slaty bands. Close to the contact in the Coronation-Beechworth area the sandstone has been silicified to some extent, and helps by its superior hardness and resistance to weathering to form this escarpment. Shearing close to the contact, and cleavage planes throughout the general mass of these rocks have also been developed, the cleavage traces trending 130 degrees E of N. South of the Beechworth lode shear, silicification and shearing are much less evident and the topography is more of an undulating character.

In the region approximately one mile south of the Central Shaft another escarpment line swings in from the north-east and trends southward through the Queen Bee and down to Narri Trig. The rocks forming this escarpment underlie the sandy beds to the west and are of a varied character. They strike roughly north-west at an angle to the contact and dip in towards it. The younger beds consist of thick conglomerate made up of large to medium sized waterworn and elongated quartzite pebbles.

The massive conglomerates of this area under-lie medium-grained sandstone grading into coarse grit and containing a few elongated quartzite pebbles. Although conglomerate in one sense, these beds are not to be confused with the more massive type of rock overlying them. They outcrop to the south of the Queen Bee mine and form the main Queen Bee escarpment.

In the Illewong Area, the overlying fine-grained beds of yellow slate, argillaceous sandstone and fine tuff lens out and the hangingwall rocks to the immediate south-east consist entirely of a thin bed of medium-grained red sandstone overlying the coarser sandstone containing quartzite pebbles.

It is in these beds that the two outcrops of quartz felspar porphyry occur. These latter are coarse-grained in character. Orthoclase is the main felspar and both it and the quartz have formed coarse crystals set in a dark grey aphanitic ground mass. Some felspar crystals measure up to three quarters of an inch along the crystallographic "c" axis. The porphyries do not appear to have had any effect on the general structure or lithology of this area other than to have formed the usual siliceous aureole in the surrounding country rock. The two intrusions are of slightly different colouring, the northern one slightly lighter in colour than the southern, but otherwise they are megascopically the same. It is possible that they are connected with the same magma that is responsible for the mineralisation of the Cobar Area.

South of these sandstone beds, thick conglomerate again outcrops for some distance and is overlain by a relatively thin bed of red coloured medium-grained sandstone followed by sandstone containing a few quartzite pebbles. A band of coarse crystalline tuff outcrops at the northern extremity of the Narri mountain proper and then gives way to coarse red sandstone followed by a finer-grained yellowish micaceous sandstone. Conglomerates outcrop again farther south.

It is considered that the finer-grained beds of the western area near Narri Trig, which also include a thick series of conglomerates slightly farther north, may be part of the hangingwall and could be a continuation of the younger fine-grained hangingwall rocks in the Illewong area. However, this has not been definitely established.

ECONOMIC GEOLOGY.

Reference is made to Mr. Sullivan's report No. 1947/74:- "Perhaps the most important point arising from the conception of the existence of a discordant contact of regional character and predating the lode shearing is its application to regional prospecting. This feature, is in itself, a lode channel and ore bodies may occur in its vicinity - folds in the contact similar to those found at New Cobar, Chesney, and New Occidental should be carefully sought for and particular attention should be paid to the area lying southward from these".

The area in the immediate southern vicinity of the Peaks was mapped and it was found that a fold similar to those mentioned in Mr. Sullivan's report existed in the discordant contact there. (See Photo 11888, Run 6). The actual "bend" is obscured

by a covering of alluvium and is in an area which has not yet been tested either by a crosscut or by a drive from the Peak or Conqueror shafts or by diamond drilling. The presence of a bend suggested a more intensive examination and a geophysical investigation was carried out by Geophysical Section of the Bureau of Mineral Resources in conjunction with Zinc Corporation. Under the supervision of Mr. L. Richardson, Superintending Geophysicist, the area was surveyed by Mr. N. Keating, using magnetic methods. A large anomaly was found to exist in the area of the bend, with the peak of the anomaly in the centre of the bend between L.P.118 on the zero traverse (made by the Geophysical Section) and L.P.118 of the 200 ft. S. eastern traverse. (See enlarged tracing of photo 11888, Run 6). This information leads further weight to the concept that bends in the discordant contact are closely allied to ore deposition even though it is realised that the presence of a magnetic anomaly does not necessarily mean the presence of a deep seated orebody.

A parallel to the bend in the Peaks area appears to exist in the vicinity of the old Illewong township. Here the contact swings to the east in characteristic fashion, the bend in this case occupying a larger area than does the one at the Peak. However, it should be noted that the evidence is not as distinctive, but nevertheless, is sufficient to show that a fold in the contact of some magnitude does exist and this being the case it is logical to assume that shearing associated with this dislocation may account for the presence of the Queen Bee lode. This lode has no obvious explanation by any other structural concept. It is formed on the contact between competent beds of coarse to medium-grained sandstones containing a few quartzite pebbles and incompetent beds of argillaceous sandstone and interbedded fine tuffs and yellow slates. Both these series of beds belong to the hangingwall whilst the footwall beds on the western side of the contact consist generally of brown slate and thin lenses of argillaceous sandstone. It is reasonable to postulate that the competent sandstone forming the Queen Bee escarpment acted as a sort of a buffer for the compressional forces which caused the folding in the discordant contact in this area and that this buffering action would tend to lead to shearing etc. with resultant ore deposition taking place away from the bend in the discordant contact.

This should in no way affect the possibility of ore being deposited south of the actual bend as here a different set of conditions would exist and the locus of maximum compression would be in a similar position to that already established in the Peaks Area, Occidental, Fort Bourke and Chesney bends. It is, therefore, considered that this area presents an excellent opportunity for further investigation.

The numerous examples of mineralization along the discordant contact in the form of quartz reefs do not appear to offer any economic possibilities. In the main they are of a minor nature and have been thoroughly prospected. Several qualitative tests using dolly pot and panning dish were carried out in reefs which had not been previously prospected without any favourable results being obtained. The lodes are buck quartz in character, but in some cases show evidence of staining by iron and manganese oxides.

Gossanous material in the form of limonite replacing slaty rocks is of common occurrence. One small gossan in the Peak area shows distinct evidence of copper staining. A large outcrop of this type occurs in the Marri Area. It is situated roughly midway between the Marri Trig and the main Cobar-Nymagee Road (the gossan may be reached by turning off the main road at Breens tank and following the track to the Rookery for a distance of six miles) and its size alone makes it interesting.

The gossanous material is limonite replacing brown slate and extends north-south for a distance of approximately 900 feet by 100 feet in width. As far as could be ascertained it has not been prospected. Mr. Keating was asked to carry out a preliminary magnetic test of the area, but the result of a traverse along the centre of the gossan and one at right angles to it for approximately 30 feet on either side resulted only in a slight magnetic variation being obtained. However, this particular outcrop would possibly lend itself more suitably to leached outcrop interpretation. The gossan lies in a mineralised belt running in a general south-easterly direction and this belt could quite easily represent the general line taken by the discordant contact in this area. If this is found to be the case then it would take on added significance from an economic viewpoint.

CONCLUSION.

It is here considered that a discordant contact of regional character as suggested in Mr. Sullivan's report No. 1947/74 is a distinct geological feature and that the desirability for further detailed examination of it is amply demonstrated by the results of geophysical testing of the Peaks area which have already been outlined.

The Queen Bee-Illewong area in particular, is recommended for further geological and geophysical examination.

It is suggested that the procurement of enlarged prints of the aerial photographs covering the Cobar-Nymagee Area would greatly facilitate and expedite any further detailed mapping in this region.

G.F. Joklik. B. P. Walpole.

APPENDIX.

By C.J. Sullivan.

The area described by Messrs. Joklik and Walpole, Student Geologists, has been discussed with them and it is agreed that the following points require to be investigated:-

(a) The position of the discordant contact to the west of Illewong township, Queen Bee area. It is considered (C.J. Sullivan) that the actual contact runs slightly to the east of the Queen Bee Mine which is marked by the escarpment occurring in that vicinity.

(b) The relationships between the beds lying to the east of the Marri-Queen Bee escarpment. It is intended that G.J. Joklik carry out further mapping in this area.

(C.J. Sullivan)
Superintending Geologist.