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ELDORADO AREA.

ENTERPRISE MINE.

Introduction.

A geological survey of the Enterprise Gold Mine was carried out in 1950 by B. P. Walpole and J. F. Ivanac, assisted for a short period by E. M. Bennett. The leases comprise P.G.L. 775, P.G.L. 811, and G.M.L. 4E. The Enterprise Gold Mine is situated 3½ miles from Tennant Creek township on a magnetic bearing of 170 degrees. It is reached by travelling south from the township along the Stuart Highway for a distance of three miles and thence due east for approximately one mile along an all weather fireplough road.

The mine is approximately five miles distant by road from the No. 3 Government Battery. The Eldorado Mine is situated approximately 1 mile to the east.

History and Production.

The Enterprise orebody was discovered in 1935. Production commenced in that year, and was maintained until 1942, when mining operations were suspended under National Security Regulations introduced during World War II. After the war, the mine was worked by a Company, who erected a small, three head stamp battery on the lease. The battery stamps, however, proved to be too light for the massive hematite, and ore had to be carted to No. 3 Government Battery. After cessation of operations by the Company the mine was worked for a short period by the owner, Mr. S. Richards and later and more successfully worked on tribute by Mr. D. King, and Mr. S. Sanderson. The tribute expired in February, 1951, and the owner Mr. S. Richards resumed operations. The mine leases and their immediate environs were included in a magnetometer survey of the Eldorado-Mt. Samuel Line in 1936. The results of this survey are contained in the Second Report on Magnetic Prospecting by the Aerial, Geological and Geophysical Survey of Northern Australia.

Production figures of the mine are listed in the table below:

	Ore Production	Recovery by Amalgamation (dwt. per ton)	Tailings (dwt. per ton)
1935-1936	58.50	21.4	
1937-1938	152.00	22.8	
1938-1939	313.19	31.96	
1939-1940	92.16	6.5	
1940-1941	550.67	33.5	
1941-1942	1692.93	12.8	
1942-1943	No production.		
1944-1945	35.00	20.6	
1945-1946	32.00	64.7.	
1946-1947	355.51	12.9	
1947-1948	685.97	27.14	7.7
1948-1949	286.6	11.8	3.1
1949-1950	962.96	19.4	4.85
Total	5217.49	19.9	

The surface and underground plans accompanying this report, indicate the development which has been carried out to the end of October, 1950. All levels were accessible at the time of the survey. Timber supports have not been found

necessary at any stage of the development. At the time the survey was carried out, ore was being mined chiefly from the western end of the main stope below the 122 foot level. The broken ore is rilled down an ore pass, through a "grizzly" on the 183 foot level, and then passed into an ore chute on the 223 foot level, from where it is hauled to the surface.

All ore is now treated at the No. 3 Government Battery. The mine workings are confined to the western quartz hematite body has been prospected only by a few shallow costeans. Mr. W. A. McDonald, mines inspector at Tennant Creek, estimated mining and treatment costs for the Enterprise mine in 1950 as £6.1.3. per ton, i.e. equal to 8 dwts. per ton.

General Geology.

The Enterprise Gold Mine is situated on a highly dissected east-west ridge, which forms the southernmost outcrop of Warramunga Group sediments on the Tennant Creek Gold-field. The mine hill itself is partly razor backed in shape and falls steeply to the south-east and west, and less steeply to the north. It is almost completely surrounded by other small hills which are similar in shape, flat or gently sloping, mesa type hills.

To the north and south, the dissected ridge slopes into extensive alluvial plains.

Rock outcrops on the lease are good, and allowed the sedimentary succession to be studied in detail. South of the lode, a thickness of 200 feet of sediments was mapped, but this figure does not represent the total thickness exposed. The character of these sediments and their thickness has an important bearing on ore localization. For this reason these features are listed below and will be discussed in the section of the report devoted to Economic Geology.

Type of Sediment	Thickness
Medium grained sandstone and cherty slate	25 feet
Argillaceous sandstone with sandstone, mudstone and siltstone as interbedded lenses	32 feet
Medium grained tuffaceous and cherty sandstone	8 feet
interbedd siltstone, mudstone and sandy siltstone.	60 feet
Sandstone with lenses of siltstone and mudstone	5 feet
Pink tuffaceous sandy shale with interbedded lenses of medium grained sandstone.	15 feet
Medium to coarse grained sandstone	55 feet
Total	200 feet

The sediments which outcrop to the north of the lode, dip away from it and hence play no part in ore localization. Sedimentary types mapped consist of interbedded hematite shale, coarse grained, medium grained and cherty sandstone, tuffaceous sandstone, siltstone and sandy siltstone. Marked lensing of the sediments produced by gradational changes is very common and points to shallow coast line conditions of sedimentation.

Underground development headings have penetrated the country rock in several places. The principal rock types exposed underground are green medium-grained sandstone, pink fine-grained to medium-grained cherty sandstone, buff coloured siltstone, red mudstone and chlorite schist.

The predominant rock colour in the upper levels is reddish brown, which passes downwards into buff coloured rocks and finally to the green sandstones. This change in colour from red through buff to green is a function of weathering and has been noted or other mines on the Tennant Creek Gold-field.

Plate shows that the shaft passes through the following rock succession:-

Collar of shaft to 71 feet - reddish competent sandstone with lenses of siltstone.

70-120 feet - buff coloured siltstone with mudstone and argillaceous sandstone lenses.

120-223 feet - buff coloured sandstone gradually passing into medium grained green sandstone.

There is a possible correlation between the incompetent sedimentary horizon outcropping at the surface between 100 S and 200 S (plate), and the incompetent sediments intersected between 72 feet and 122 feet below the collar of the shaft.

Economic Geology.

Lodes.

The two quartz hematite bodies which outcrop on the lease are roughly "tear-drop" in shape, tapering out towards the west. The aces of both bodies strike approximately east-west. Both are 200-250 feet in length and each has a maximum width at the surface of approximately 50 feet.

At the surface, the quartz hematite of the western body is a hard, massive, blue-black, highly magnetic variety, and contains very little megascopically visible quartz. The southern boundaries of both bodies are linear in plan. The northern boundaries are serrated - probably due to the control of lode material distribution by feather faults.

The quartz hematite of the eastern body ranges in character from the dense massive and magnetic variety, to a more vuggy type which in some places shows faint ribwork structures.

The western quartz hematite body has been mined on five levels at 32 feet, 72 feet, 122 feet, 183 feet and 223 feet below the collar of the shaft. The levels are connected by rises or winzes, most of which are now inaccessible or are being used as ore passes. A cross cut along 00 (Plate) at the 128 foot level, intersected 87 feet of lode before passing into country rock. This is probably the maximum thickness attained by the lode. On this level the lode has been developed over a length of 120 feet. Ore has been stoped from between 50N 35E to 8S 53W (Plate), a length of 89 feet, and an average width of ten feet. The distribution of gold values in this ore-shoot was extremely erratic, ranging from patches and stringers which assayed up to 60 ozs. of gold per ton to sections as low as 3 dwts. per ton.

Individual and much smaller ore-shoots, in places connected by thin "stringers" of ore to the main shoot at the 122 foot level, have been mined from the 183 foot, 72 foot and 32 foot levels. At the 223 foot level, a small independent ore shoot has been stoped.

At all levels except the 223 foot level, a marked change in character between lode and ore is apparent, the lode is generally strongly-jointed, dense, massive crystalline quartz-hematite, or as is the case on the 183 foot level, grey black and white pulverent hematite-rich material in places stained with manganese dioxide. The ore on the upper levels and in the main stope below the 122 foot level, is a pulverent sericite-rich hematite-impregnated

brecciated mustone containing small pods of hard hematite. The ore on the 183 foot level is a crushed red mudstone containing free gold and stringers of hematite. On the 223 foot level, the values occur in hard massive quartz hematite containing relatively softer patches which localise the higher values.

The richer sections of the ore contain a high proportion of bismuth carbonate, probably Bismutite - which usually occurs in intimate association with, and may mask the free gold. The gold is often megascopically visible and varies from fine to coarse grainsize.

Despite the high proportion of bismuth carbonate in the richer section, the ore amalgamates successfully. Gold fineness of ore treated in 1949-1950 varied between 936 and 982.

The distribution of payable ore throughout the whole mine is erratic. Assay walls and flat lying layers of dense hematite containing very low gold values are common in the main stope. The highest assay values are obtained from thin stringers of ore which parallel the strike of the lode and commonly connect individual ore shoots.

Structural Control.

A study of the regional geology of the area shows that the Enterprise lodes lie in a feature zone on the northern limb of an east plunging anticline.

South of the line of the lode, the beds strike at approximately 100 degrees magnetic, and dip at angles which range from 15 degrees and 45 degrees to the north. Fracture cleavage strikes between 80 degrees and 90 degrees magnetic and is generally vertical. To the north, and on the southern side adjacent to the western hematite body, the beds have been contorted by shearing stress which has been resolved as drag folds shear fractures and brecciation. Movement along the shear planes is west block south.

Drag folding south of the line of lode is indicated by a swing in the strike of the beds from 100 degrees to 60 degrees magnetic (see 00-100E and 00-100S Plate), with a resultant reversal of plunge to the west. It is probable that a similar drag fold occurs immediately south-east of the eastern quartz hematite body, but lack of outcrops prevented this from being definitely established. The reversals of plunge have probably terminated the horizontal extent of the quartz hematite lodes.

Within the western quartz-hematite body, the ore shoots are localized in crush zones between two intersecting sets of fractures. The main ore control is a general east-west direction of faulting of which the King Fault (see Plate) is the most pronounced unit. The main ore shoot, is localized by the intersection of the Sanderson Fault and the King Fault. Both of these faults dip at angles between 70 degrees and 75 degrees to the north.

Reversal of plunge cuased by the drag folding has imparted a steep westerly plunge to the lode whilst the overall pitch of the oreshoot is to the east. The outline of the main ore shoot and shows it to be cusp-like in long section with the eastern extremety pitching west and the western extremity pitching east.

Drag folding of the beds under shearing stress and the difference in degree of competency of the beds, has resulted in strong faulting and fracturing off the nose of the drag fold and along the limb of the major structure. The fractures assume a rhomb-like pattern of stress relief, the direction of the arms of which correspond very closely to the strike of the fracture cleavage and to the strike of the axes of miniature corss folds which occur in a bed of hematite shale outcropping at 30N 120E. Resolution of the forces has led to pronounced faulting along

a general 90 degress to 100 degress magnetic direction and the formation of feather faults striking at between 55 degrees and 75 degrees magnetic. The conjugate pattern of fractures thus set up has directly controlled the shape and dimensions of the lode at the surface as well as being one of the prime casual factors in localizing the ore underground.

Sedimentary Control.

In common with other orebodies on the Tennant Creek Gold-field, the gold values in the Enterprise mine are closely associated with the incompetent beds and with mudstone in particular. The potential ore horizon on the Enterprise lease is markedly gradational in character, a feature which may be seen both underground and on the surface and which partly explains the erratic distribution of the gold values. This is probably further accentuated by the tendency of the mudstone to flow under stress.

The low grade sections which occur in the ore-shoots are probably due primarily to lenses of unfavourable sediment intersecting the lode.

The overall east pitch of the ore-shoots is considered to be a reflection of the favourable incompetent sedimentary horizons pitching into the zone of fracturing from the west.

Sedondary Enrichment.

It is probable that secondary enrichment has played an important part in the concentration of high gold values. In support of this assumption, the following reasons are advanced:

(1) The zone is impoverishment from the surface to the 32 foot level, where high assays should have been expected.

(2) Low gold assays in apparently favourable host rock on the 183 foot level.

(3) The richest ore shoots lie in a perched zone of highly weathered country rock which extends from the surface to the 183 foot level approximately. This zone is a considerable distance above the present water table level, and represents long and continued weathering of a more or less stable land surface. Its present position above the waterhole is due to either uplift of the land surface or a depression of the water table level. Kaolinization in this zone is fairly marked and it is suggested that such intense weathering must have played a part in solution and redeposition of gold.

(4) Gold occurs as flakes, scales, and grains in cracks and along cleavage planes in lode as well as in the ore.

PATTIES MINE.

The Patties Gold Mine is situated 3½ miles south of Tennant Creek township and the lease has common boundaries with the Eldorado and Enterprise leases. Production commenced in 1939, ceased during World War II, and was re-commended in 1947. In 1949 exploration of quartz hematite blows on the lease was carried out by percussion drilling, but without result. In 1950 D. King obtained an option on the lease. 1,369.48 tons of ore, which averaged 16.7 dwt. per ton by amalgamation and 4 dwt. per ton in the sands, have been mined.

The lode has been worked from two shafts, one 85 feet deep and the other 170 feet deep (vertical to 85 feet and underlay for the remaining 85 feet). Drives and crosscuts have been unlegged at 85, 110, 135 and 170 feet.

The sediments, interbedded sandstone, mudstone, siltstone and hematite-shale, which crop out on the lease, have been folded and sheared. Bedding dips and intersection of bedding and cleavage indicate that these sediments lie in the north limb of an east-plunging anticline. Rock failure as a result of folding has induced brecciation and shearing in the country rocks, and such breccia zones have been partly or completely replaced by quartz-hematite.

Several east-west striking quartz-hematite lenses crop out on the lease, and mining activities have been concentrated in the partly replaced crush zone on the south side of the western most outcrop.

The main oreshoot is lenticular, extends from the 52 to 135 ft. levels and aggregated 11.2 tons of ore per vertical foot. The ore consists of red brecciated mudstone, sericitised, and impregnated with quartz-hematite stringers. Gold occurs as grains, flakes and scales on cleavage fracture planes and is in places visible to the naked eye. Finely disseminated gold visible only by dollying and panning is more widely distributed.

From the 85 ft. level to the 110 ft. level dense massive hematite has been worked over a length of 15 feet and a width of 11 feet, a total of 16.5 tons per foot of development. The grade was reported to be sporadic, although some high grade ore was mined and is probably due to enrichment of fractures in the quartz-hematite.

ELDORADO MINE.

Summary.

The Eldorado gold mine is the largest producer of gold on the Tennant Creek Gold-field. The gold-bearing lodes lie in an area of pitch change on the north limb of a west plunging anticline. The lode bottoms a north-dipping thrust fault. Ore is localised where an inbrecciated mudstone bed is intersected by steeply dipping faults. Results of previous geophysical investigations are included.

Introduction.

The examination of the Eldorado Gold Mine was commenced during the 1948 field season and mapping of development headings was brought up to date in 1949 and 1950. J. F. Ivanac and N. H. Krasenstein mapped the geology of the mine. The Eldorado Gold Mine is operated by a private company and is under the management of Mr. Cliv Palmer.

The Mine is situated approximately 3½ miles south of the Tennant Creek township and is approached either by a gravel track which runs direct from the town to the mine, or by following the Stuart Highway southward for about three miles, and then turning eastwards along an all-weather fireplough road for about a mile and a half. The mine has its own battery treatment plant, which is however, only operated for about eight hours per day. A cyanidation plant has been erected on the lease but has not yet been used for ore treatment. Water for treatment purposes is obtained from the company's bore one mile south of the mine and from seepage into a sump below 300 foot level. Potable water has to be transported from the Town bores 10 miles north of the mine.

History, Production and Workings.

The Eldorado deposits were discovered in 1932 but large scale production di not commence until 1934.

Several prospectors and one or two companies attempted to work the deposit but with little success. In 1938, a Government bailiff was placed in charge of the mine in order to administrate its affairs. Following this, the Eldorady Pty. Ltd., was formed and this company prospected the lode by shallow shafts arranged on a grid pattern and by several long north-south costeans.

In the years 1935-36 the Aerial Geological and Geophysical Survey of Northern Australia conducted a geophysical survey of the Eldorado and adjacent bases. Three major magnetic anomalies were discovered (Plate) in close proximity to the Eldorado Gold Mine.

The recorded production of the mine is listed below:

Date		Tonnage Long Tons	Gold Won by Amalgamation dwt. per ton.	Tailings dwt. per ton.
July 1934-June	1935	489	11.2	
35	36	3,914	10.8	
37	38	5,834	9.1	Note: Prior
38	39	3,349	12.8	to 1941-42,
39	40	6,681	10.2	18,425.2 long
40	41	7,949	11.8	tons averaging
41	42	8,355	11.8	2.3 dwt. per
42	43	6,037	17.4	ton.
43	44	5,385	13.0	
44	45	5,121	28.0	
45	46	4,844	18.4	
46	47	6,534	17.2	
47	48	6,188	14.2	
48	49	5,168	11.0	
49	50	5,475	15.7	
	TOTAL	80,908	12.83	No available.

The Eldorado was the only established mine operating at Tennant Creek when the Sedond World War commenced and for this reaspn was permitted to continue in production.

The ore deposits have been won from an opercut and by underground workings. In the former case the ore was rilled down to the 200 foot level and hauled to the surface through the main shaft. The open cut is 150 feet long, 35 feet wide and approximately 50 feet deep. Ore was extracted from two-thirds of this cut, and the remainder of the mined material was used as filling.

Several shallow pits Nos. 2, 3 and 4 (Plate) have been sunk to depths 15, 6 and 5 feet respectively. These and the narrow conteans were used in the early exploration of the deposits. Most of them have been subsequently covered by talus and mine waste.

No. 1 Shaft, the only haulage shaft on the lease is a three compartment shaft measuring 10 feet by 6 feet and has been sunk to a depth of 307 feet. Levels have been opened up at 50, 100, 150 and 200 and 300 feet below the colar of the shaft (Plate and). Winzes and rises connect these levels and serve as mainways and ore-chutes. Exploration at the 400 foot level has been carried out by a vertical winze from the 300 foot level (Plate), and by an east cross-cut with short north and south drives. At 330 feet a shallow drive and crosscut were unlegged. From the 400 foot level (Plate) and underlay rise was connected to the 300 foot level.

All ore hauled to the surface is tipped through a grizzly, into a jaw crusher; from here it is conveyed by rubber belt to battery stamps and treatment plant. The gold is amalgamated with mercury on copper plates, supplemented by grinding plans. Tailings are stockpiled pending cyanidation. The cyanidation plant is almost completed and some 62,000 tons of tailings will be treated.

The exploitation of the ore has necessitated over 3,000 feet of driving and crusscutting. The workings are in good condition and the ground "holds" exceptionally well. Timber is used only in the main shaft, winze collars, and stope chutes. Ventilation is not a great problem as the 50 and 100 foot levels are connected to the opencut which allows for an effective downdraught of air. The east stope also reaches the surface east of the opencut. The Company possesses an underground E100 diamond drill but to the present this has never been used in exploration.

General Geology.

The Eldorado Gold Mine is situated on an east-west trending ridge which falls very steeply to the south of the mine, but slopes very gently to the north and east. This part of the ridge is lower than the general level of the old Tertiary peneplain. Outcrops are partly concealed by soil and talus and by by Tailings dump and abandoned mining equipment. Several shallow dry water-courses dissect the lease.

The sediments consist of interbedded, medium-grained ripple-marked sandstone, tuffaceous sandstone, tuffaceous siltstone, hematite shale and mudstone. The sedimentary succession shows competent sandstone overlain by the less competent and finer-grained facies and a measured sedimentary succession is shown below:

From	To	Thickness (Feet)	Description.
0	- 95	95	Hard red medium-grained sandstone, in places ripple marked.
95	- 100	5	Blocky hematite shale. This rock is reddish brown in colour with $\frac{1}{8}$ inch thick hematite stringers which are parallel to bedding.
100	- 111	11	Pale purple siltstone.
111	- 121	10	Hematite shale
121	- 137	16	Thinly bedded fine-grained sandstone
137	- 210	73	Mudstone.
210			Gradation into Tuffaceous siltstone.

The sediments have been thoroughly leached between the surface and the 250 foot level. Colours are those which characterise the zone of oxidation such as brown, purple and white. Below this zone the rocks are predominantly green with a slight change to reddish green near the present water table level.

The base of the oxidized zone may be described as a perched water table level which is probably associated with a water table level of pre(?)-Tertiary times.

Economic Geology.

(a) Lode:

Several quartz-hematite lodes outcrop on the lease and are either elongate or lenticular in plan. The lenticular blows trend in north-easterly direction and have a maximum length of 115 feet and a maximum width of 40 feet. The elongate bodies strike east-west parallel to the cleavage and have a maximum length of 150 feet and maximum width of 4 feet.

The quartz-hematite lodes lie in a crush zone, and consist of an intimate mixutre of quartz-jasper and hematite (probably martite after magnetite). The variations in percentage of these constituents, partly depends on the sedimentary rock types the quartz-hematite has replaced. Where the sediments are interbedded sandstone and slate, the composition of the lode is approximately 35 per cent. jasper, 30 per cent. quartz and 35 per cent. hematite, and where quartzitic sandstone is replaced the ratio is approximately 50 per cent. quartz and 50 per cent. hematite.

The hematite is a blue-black variety with a dull lustre. In places this type gives way to the lustrous specular type. Micaceous hematite occurs on the 300 foot level. Underground quartz-hematite segregations and massive replacement bodies and surrounded by partly-replaced, brecciated mudstone and sandstones. The edges of breccia fragments are surrounded by thin hematite stringers with nonpreferred orientation. Sericite, limonite, manganese oxide, kaolin, possibly bismuth oxide and carbonate and quartz-muscovite veins are associated with the lode. The limonite is ochre-yellow in colour and formed the main part of a narrow vein, rich in gold, at the intersection of the Thomas Fault and Pug Seam Fault in the Central stope on the 100 foot level (Plate). Manganese oxide stains are very common on the 300 foot level. Kaolin is widely distributed and occurs as thick seams along curved tension joint planes in the massive hematite. A quartz muscovite vein, approximately one inch wide was observed in a fracture in the hematite on the 200 foot level.

Massive barren quartz veins cut the lode in places but are not widely distributed. They belong possibly to a third phase of quartz injection. From present knowledge of the mine the writer is inclined to the opinion that there are three periods of quartz injection:-

(1) closely associated with the introduction of magnetite

(2) quartz-muscovite veins

(3) barren quartz-veins.

Several oreshoots have been worked in the quartz-hematite lode and these are known as East Shoot, Central Shoot and the Western Lenses. They are pipe like bodies with a circular and elliptical cross section. The oreshoots are confined to the one lode and consequently are inter-related.

1. East Stope. Plate shows the general outline of the East Stope which has been worked on the 100, 200, 300 and 400 ft. levels. The stope is divided into two sections, the south-western limb and the north-eastern limb which are separated by the Thomas Fault. On the 100 foot level the south-western limb is 35 feet wide and 52 feet long, and has yielded approximately 180 tons of ore per vertical foot. This portion of the East Lode extends from the surface to about 10 feet below the 100 foot level. The oreshoot is terminated to the west by the Pug Seam Fault (Plate) and to the north by the Thomas Fault. Assay walls limit the ore to the south and east.

The north-eastern limb (Plate) has its maximum dimensions on the 200 foot level where it is 40 feet wide and 50 feet long, and averages 180 tons of ore per vertical foot. It is bounded to the west and to the south by the Pug Seam and Thomas faults, respectively. The east and west limits are determined by assay. This limb of the lode considerably overlaps the south-western limb (Plate), and originated 35 feet below the 100 foot level. It continues as an uninterrupted pipe to the 400 foot level where there is a marked decrease in size and grade of the orebody. At this level the yield is only 40 tons per vertical foot.

Present production from the Eldorado Mine is solely from the north-eastern limb of the East Shoot.

2. Central Stope. The Central oreshoot has been worked at the surface 50, 100 and above the 200 ft. levels. The outline is similar to the East Shoot in that the orebody has a north-eastern and a south-western limb, which have a pipe-like outline in section. The north-eastern limb lies in the hanging wall of the Thomas Fault and has been mined from the 100 foot level to about 10 feet above the 200 ft. level. A maximum of 210 tons of ore per vertical foot of development has been mined from this section. The ore is bounded to the west by Fault A, and to the east by the Pug Seam Fault. The Thomas Fault determines the footwall and the northern limits are determined by assay.

The south-western limb extends from the 100 foot level to the surface. It is bounded to the west and east by Fault A and the Pug Seam Fault respectively. The Thomas Fault determines the hanging wall and the southern limits have been established by assay. There is a marked sedimentary change from mudstone to sandstone in the footwall of the ore and this appears to be responsible for the decrease in grade.

At the surface the orebody was 80 feet long and 35 feet wide, but decreased in size to 50 feet long and 10 feet wide at 100 feet below the surface.

The ore is a lightly brecciated mudstone dissected

by ramifying quartz-hematite stringers and massive quartz-hematite replacement bodies.

3. Western Lenses. West of the East and Central oreshoots a group of irregular ore lenses, known as the Western Lenses, have been mined. The 100 foot level plan shows some of these lenses, which have given a production tonnage of 70, 45, 25 and 21 tons per vertical foot of development. There are several other lenses but these were inaccessible at the time of the survey.

The ore is contained in soft mudstone and sandy mudstone fragments in dense, hard, blue quartz-hematite. In some places gold was found in kaolin seams in the lode. The distribution of gold values was erratic and as the lenses were all relatively small in size and of irregular occurrence, the mining costs in this section were, consequently, high.

These observations have been made in and above water-table level. Deep drilling north of this deposit located grains of chalcopyrite, pyrite and a little calcite. The iron mineral was predominantly magnetite, as the core was highly magnetic.

Structural Control.

The Eldorado lode and ore-shoots have been localised by combined structural and sedimentary controls. The relationship of bedding to cleavage, direction of plunge, and attitude of drag-folds show that the Eldorado lode is situated in the north limb, a 22 degree east-plunging anticline. Axial plane of the anticline strikes east parallel to the regional cleavage, and dip is 65-75 degrees north. There are two major plunge changes in the sediments on the lease; the most important is situated at 110S, 150E, where the plunge is 8 degrees east. The strike of the axis of plunge change is possible north-east parallel to a measured direction on the Enterprise Mine one mile west of the Eldorado. This plunge change has resulted in the formation of a basin, in the crests of drag folds (east-striking axial planes). This postulation could not be verified underground, where bedding is greatly disturbed by faults.

Associated with this folding are three prominent fault types all of which play an additional and equally as important part in lode and ore localization.

The base of the lode is determined by Fault B a north-striking thrust fault. Angle of dip of this fault ranges from 20-25 degrees on the 200 foot level, 40 degrees on the 300 foot level and 20 degrees at the 400 foot level. This important change of dip (to 40 degrees) is associated with a change in strike of Fault B of 37 degrees, and possibly may have led to the formation of vertical tension faults Fault A and Pug Seam Fault. These faults terminate on Fault B; they strike north-east parallel to the main axis of plunge change. Crush zones of these faults consist of a chlorite-talc schist, with slickensides plunging 20 degrees east, in the same direction as the dip of Fault B. The walls of the ore-shoots are determined by Fault A and Pug Seam Fault on the 100 and 200 foot levels. On the 300 foot level the long axis of the ore is parallel to the strike of the Pub Seam Fault and to that of the axis of plunge change.

A very important fault control independent of Fault B and associated tension faults if the 40-70 degrees north dipping Thomas Fault. This fault is generally parallel to fracture cleavage, strike and dip, from the 200 foot level to the surface, but as depth increases, it gradually assumes the bedding plane direction. The Thomas Fault may have been originally a bedding plane fault, but attenuation and distortion of the incompetent sediments in the limb of the structure has almost obliterated bedding and substituted a fracture cleavage. The Central and East Ore-shoot have been faulted by the Thomas Fault (Plate) which has been displaced 55 feet by the Pug Seam Fault.

Considerable brecciation and attenuation of sediments is associated with the faulting, and the crush zone has formed the locus for lode and ore accumulation.

A consideration of the relationship of ore to a structure shows that the strike of the ore axis is parallel to the fracture-cleavage or axial plane of folds, from the surface to the 200 foot level; from this level the strike of the axis gradually changes until it is parallel to the stike of tension faults, and axis of pitch change. Fault B and Thomas Fault structures do not weaken, in depth whereas the vertical tension fault probably terminates in the former.

Sedimentary control plays an important part in ore localization. The ore is a replaced brecciated mudstone, and may be considered as a sedimentary bed, where can be correlated with a mudstone bed, 73 feet think, which crops out on the surface. Underlying the mudstone is a massive ripple-marked sandstone and quartzitic sandstone which has folded as a competent horizon, and which controls the dip of the Thomas Fault on the 330 ft. sub-level.

Geophysical Investigations:-

A magnetometer survey of the Eldorado leases was conducted by Aerial, Geological and Geophysical Survey of Northern Australia in the year 1935. The results of the Survey disclosed five magnetic anomalies which occurred (see Plate) at varying depths (from 223 to 759 feet) below the surface. All five anomaly centre points lie down dip and downplunge from the outcropping lode.

Details of these anomalies are contained in the attached table. *

Structural Control of Magnetic Anomalies.

Plate illustrates a possible explanation of the localization of Magnetic Anomaly No. 1. It is possible that structural conditions which influenced the position of the present lode are somewhat similar, i.e. shearing on the north limb of an east-plunging anticline with thrust faulting of the Fault B type. A suggested axis of synclinal pitch change passes through the centre of the anomaly.

Plate illustrates a possible explanation for the structural control of Magnetic Anomaly No. 3. Its position is thought to be due to shattering of the bedding due to a change in dip of Fault B. There is a possibility, however, that the anomaly may be due to the increased magnetite content of the lodes due to its position below water table level. A brief examination of the surface rocks hear and above the anomaly show that the beds have been lightly sheared and steepened from their normal dip of 20-30 degrees to 65 degrees vertical. This shearing is in an east-west direction parallel to the fracture cleavage and takes place on the north limb of an east-plunging anticline. Shales, sandstones and mudstone are the rock types present.

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* This table was copies from Northern Territory Report No. 3 (Richardson, L.A., and Rayner, J.M.).

TENNANT CREEK MAGNETIC SURVEY.

Table showing details of major anomalies detected to end of 1936.

Anomaly Number	Co-ordinates. Centre of Anomaly.	Co-ordinates. Site for Drill Hole.	Amount of Anomaly (Gammas).	Approximate Depth Predicted (feet)	Depth as Proved by Drilling (feet)	Approximate distance of Centre of Anomaly from nearest outcropping body being developed (feet)	Remarks.
1	430W/530N	420W/430W	1600	300	223	600	Detected in 1935 No. 1 Drill Hole intersected dense siliceous hematite at 223 feet 235 feet (Drilling then stopped)
2	1 0/650S	..	500	..	..	600	
3	1440E/750S	1438E/800S	450	500	413	1300	No. 2 drill hole encountered talc-carbonate-magnetic formation at 413 ft., containing disseminated sulphides. This formation continued to 452 ft. (drilling then stopped).
4	2820E/2100S	..	470	..	..	350	
5	427E/2530S	..	400	..	..	1400	Moor deep-seated than Nos. 1 - 4.