The Discovery of the Edna Beryl Gold Deposit – a journey with the destination of multiple mineral discoveries

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SUMMARY

The discovery of the greater Edna Beryl mineralisation marks a successful journey of systematic, science based exploration over a nine-year period. It is as much about the tenacity of the Emmerson exploration team and the quest for unlocking the geological code as the capability of the Board to secure funding to support this aggressive exploration during the usual peaks and troughs of the capital markets. Like most successful endeavours, the journey has always been with a clear business focus around effective and efficient exploration, taking into account the probabilities of discovery whilst using the failures as the fertiliser for improvement.

The Tennant Creek Mineral Field is famous in terms of hosting some of the highest-grade gold and copper deposits in Australia, the majority successfully discovered by either surface prospecting or, some innovative modelling of the various magnetic geophysics - the obvious "tool of choice" considering the host to the gold and copper is predominantly hydrothermal magnetite (locally termed ironstone).

In 2008 when Emmerson commenced exploration in Tennant Creek, it was recognised that most if not all of the obvious magnetic anomalies had been tested, thus leading Emmerson on a very different journey that was predicated on refining the exploration models with a more holistic view of the entire mineral system across all geological scales. Emanating from this was the hypothesis that oxidised fluid sources played a far more important role in the genesis of these deposit types and that these fluids were in fact instrumental in the deposition of ultra-high grades of gold and copper. Thus much of the research and data collection is specifically aimed at trying to better understand the role of these fluids, their possible connection to the Tennant Event and their pathways via refining the 3D structural framework.

Ultimately this approach has been successful in discovery of the Goanna and Monitor copper-gold systems, the Mauretania gold and the more recent, ultra-high-grade Edna Beryl gold mineralisation. All displaying the common theme of an association with highly oxidised, hematite rich fluids and typically associated with little or at best very weak magnetic signatures. This has opened up the entire Tennant Creek Mineral Field to a new generation of predominantly hematite hosted deposits which by virtue of their different geophysical signature, remain largely untested by previous explorers.

Key words: tenacity, discovery, oxidised, gold, copper, business

INTRODUCTION

The discovery of gold in the Tennant Creek Mineral Field (TCMF) dates back to 1935, and similarly the discovery of Edna Beryl in 1936 by prospectors who mined underground up until the closure of the mine in 1942. Mining returned to Edna Beryl in 1945-46 where several shafts and drives were developed to a maximum depth of approximately 50 metres, before encountering the water table. Production up until 1952 is reportedly 2,700t of ore at an exceptional grade of 53g/t gold.

More recently, various companies have deployed different exploration strategies to the field, perhaps the most successful utilising the Bureau of Mineral Resources aeromagnetic surveys in 1955 (Figure 1). This was successful in discovering many of the famous deposits of Peko, Juno, Warrego, Gecko and White Devil – not surprisingly all hosted in magnetite ironstones. As exploration maturity increased over time, the efficacy of utilising magnetics as a means of pinpointing the next discoveries declined. A brownfields exploration strategy by Giants Reef Mining between 1996 and 2000 outlined additional high-grade gold mineralisation at Edna Beryl, below the historic workings of the Edna Beryl East Mine, resulting in a small but very high-grade gold resource reported in 1998.

Emmerson entered the TCMF in 2008, expressly to discover new deposits through applying new ideas and technology. One of the first initiatives undertaken included a detailed, regional ground gravity survey to better highlight the main controlling structures, the trap environments of hematite shale and hydrothermal hematite, colloquially known as hematite ironstones. Whilst this was not a new idea given there are many examples of hematite hosted mineralisation amongst the iron-oxide family of deposits, it was the first time that systematic, science based exploration programs were directed specifically at the hematite endmember of this deposit type in TCMF.

Exploration Model and Results

Emmerson's exploration model was assembled around a holistic mineral systems approach whereby the various elements of the system were identified and tagged with respect to being present, absent or unidentifiable within the various data sets. It was possible to use proxies for certain elements and to also identify applicable tools to verify aspects of the mineral system (Figure 2). To our knowledge this was the first application of such an integrated approach, with much of it underpinned by applied research – both external and internal but specifically aimed at answering key knowledge gaps. One study in particular (Matt Hill, unpublished PhD) provided some critical age dates that began to confirm the connection of the mineralisation with the ca 1850 Ma Tennant Event (Figure 3).

The first indications of success came with the discovery in 2011 of the high-grade Goanna and Monitor copper-gold system. This style of mineralisation had not been recognised in the field before and consists of dismembered, hematite ironstone with Fe-rich chlorite and quartz breccia veins - all within a complex, anastomosing shear zone. Remarkably the Goanna mineralisation is some 150m from the underground development drive of the Gecko copper deposit that is hosted in a series of magnetite ironstones. Illustrating the paradigm of "you only find what you are looking for"!

For Goanna, the district scale detection tools consisted of identifying fertile structural features and screening via airborne electrical geophysics to define sulphides and associated clay alteration at the base of oxidation. This was followed up with a confirmatory, ground based Induced Polarisation survey guiding the discovery hole (GRC1355) that intersected 27m at 1.75% copper, including 6m at 3.53% copper, 14.6% iron and 1812ppm bismuth. Subsequent drilling was guided by the integration of geology, alteration and metal zonation that eventually resulted in the intersection of gold and bismuth beneath the copper mineralisation. In November 2011, drill hole GRC1367 intersected 15m at 8.13g/t gold, including 3m at 34.1g/t gold, 4.18g/t silver, 0.15% bismuth and 11.1% copper.

One of the most successful applications of the hematite mineral systems approach came from the discovery of Mauretania in a totally green-fields environment of no previous indications of outcrop, drilling or mineralisation. Discovery drill hole MTRC006 intersected 31m at 3.64g/t gold including 19m at 5.51 g/t gold and 2m at 36.2g/t gold. This discovery was one for the brave, concealed under 5-6m of shallow sand cover, defined by a favourable structural setting, a very weak ground magnetic anomaly and adjacent to where a local prospector had been finding small gold nuggets with a metal detector. Subsequent drilling has unfortunately not repeated the extent of the high-grade gold, as it appears that the system has been dissected and dismembered by later faulting.

Edna Beryl is the most recent discovery and although the area is marked by small workings, is otherwise geologically unremarkable and not dissimilar to the numerous other prospects within the TCMF. However, refinement of the regional setting provided the impetus for a concerted exploration program by Emmerson in 2016. For context, the northern part of the Warramunga basin (which is also host to the North Star cluster of gold and copper deposits) is believed to be within the upper, more oxidised portion of the Warrumunga sedimentary package and different than in the south where the Black Eye member contains voluminous syn-sedimentary magnetite facies rocks. This transition from reduced deep water sedimentation in the south to more oxidised conditions in the north is also reflected in the regional magnetics. Interestingly it also broadly mirrors the exploration maturity where the prevailing view of the past ascribed a prominent role to magnetite derived hydrothermal systems and thus the presence of magnetic anomalies.

The original Edna Beryl prospects occurs on a small hill likely a consequence of the more resistant quartz-ironstone assemblages found in the immediate area. Emmerson interest in the district occurred in early 2015 where many elements of the hematite mineral system were identified, in particular the structural setting, hematite trap rocks and proximity to the Tennant Creek intrusive suite. Further support came from the 2015 regional seismic reflection survey (co-funded by the Northern Territory Geological Survey) which positions the Edna Beryl district within a steep south dipping thrust that can be traced down some 10km below the current surface. This is likely part of a fold and thrust system similar to what controls the major deposits in the south of the TCMF.

Locally the Edna Beryl ironstones occurs within the hinge of a D1 antiform, which in turn is cut by later, conjugate D3 faults. These faults are believed instrumental in focussing the oxidised, hematite stable, gold-copper-bismuth fluids. The original magnetite ironstones are believed altered to hematite during the mineralising event, except in the upper levels where oxidation of the magnetite is from surficial processes. The presence of ultra-high-grade gold at Edna Beryl likely reflects the juxtaposition of favourable physical and chemical trap sites in the presence of the D3 structures. Recent underground mapping from the development drives broadly confirms the importance of these structural and chemical elements. It also highlights some of the challenges for mining as the interaction of these elements within a strongly deformed rock package produces widely variable gold grades, particularly when relying on the statistically small sampling medium of the drill holes. In contrast, the more robust bulk sampling from 1,200t of development ore yielded gold grades in the 35-40g/t range. These grades not only demonstrate the potential of these oxidised Au-Cu-Bi fluids in producing ultra –high grades, but also some of the challenges in reconciling the grades based on drilling (Figure 4).

Subsequent to the initial discovery of the greater Edna Beryl mineralisation, Emmerson and Joint Venture partner Evolution Mining trialled an ultra-detailed ground gravity survey consisting of stations spaced at 25m and lines 25m apart. This survey successfully pinpointed the Edna Beryl mine as a gravity high and identified probable extensions to the west. Of interest was a further gravity high immediately to the north of the mine which has gold and copper prospects at either end. As the area is covered, a reconnaissance drill

program was undertaken in early 2017. This program intersected elements of the mineral system including thickened hematite shale, alteration and in some holes, highly elevated gold and copper, suggesting proximity to ironstones.

One of the major challenges of the TCMF is the plethora of ironstones – most un-mineralised. For example, there are 700 known ironstones but only 130 mines recording some form of production (<20% of known ironstones). This high "false positive" rate for mineralisation not only needs to be accommodated in the business plan but mitigated as far as possible on the technical front. As such Emmerson continues to work toward developing various tools including a geochemical "ironstone fertility" index that aims to geochemically discriminate the fertile, barren and near ore ironstones.

CONCLUSIONS

Emmerson (and JV partners) have invested considerable resources in the Tennant Creek Mineral Field, all within a milestone driven, risk-based business framework and with the clear aim of discovery. We are increasingly confident that this approach will continue to yield new discoveries and thus be supported by our joint venture partners and shareholders. The imperative for undertaking innovative science based exploration is to greatly improved the success rate of mineral discovery – whilst there is no one silver or gold bullet, a systematic science based approach assisted by forming alliances with appropriate research institutes and consultants, but within a business framework go some way toward improving the base rate of discovery and thus the investment case for our shareholders.

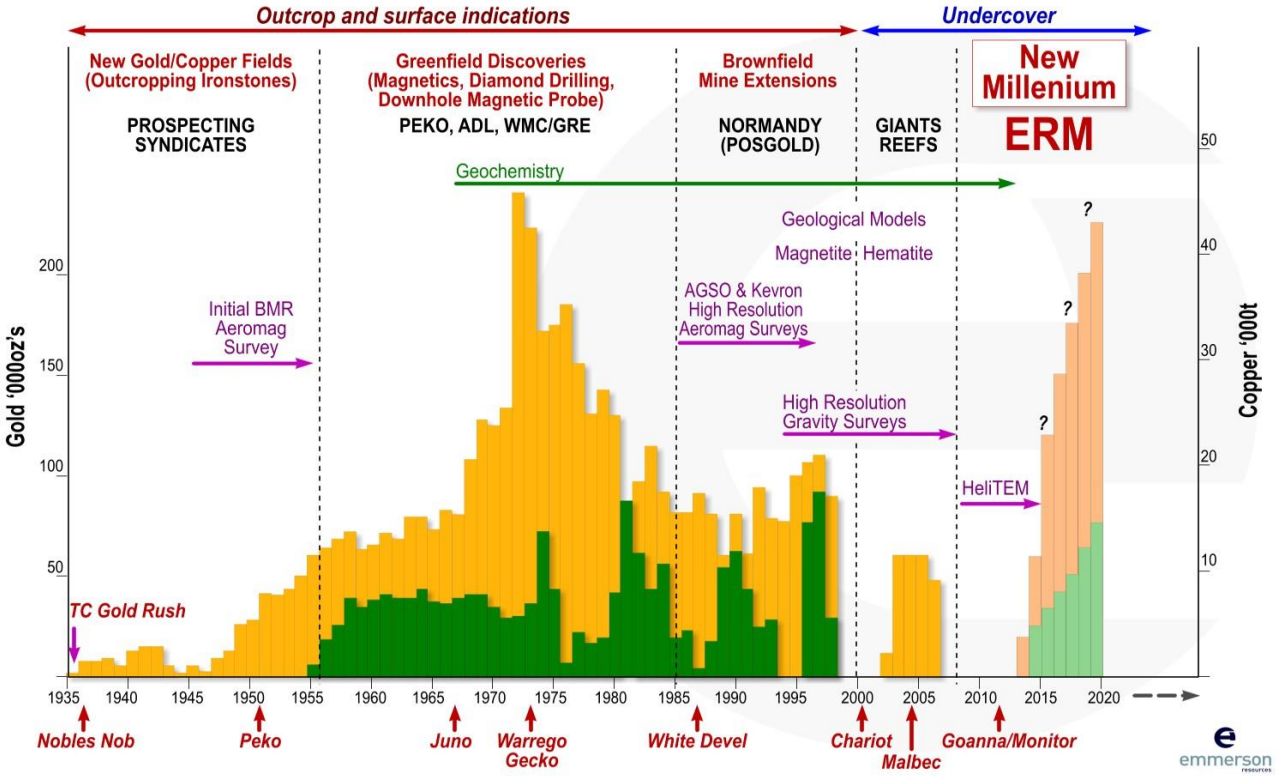

Figure 1 Discovery history of the Tennant Creek Mineral Field

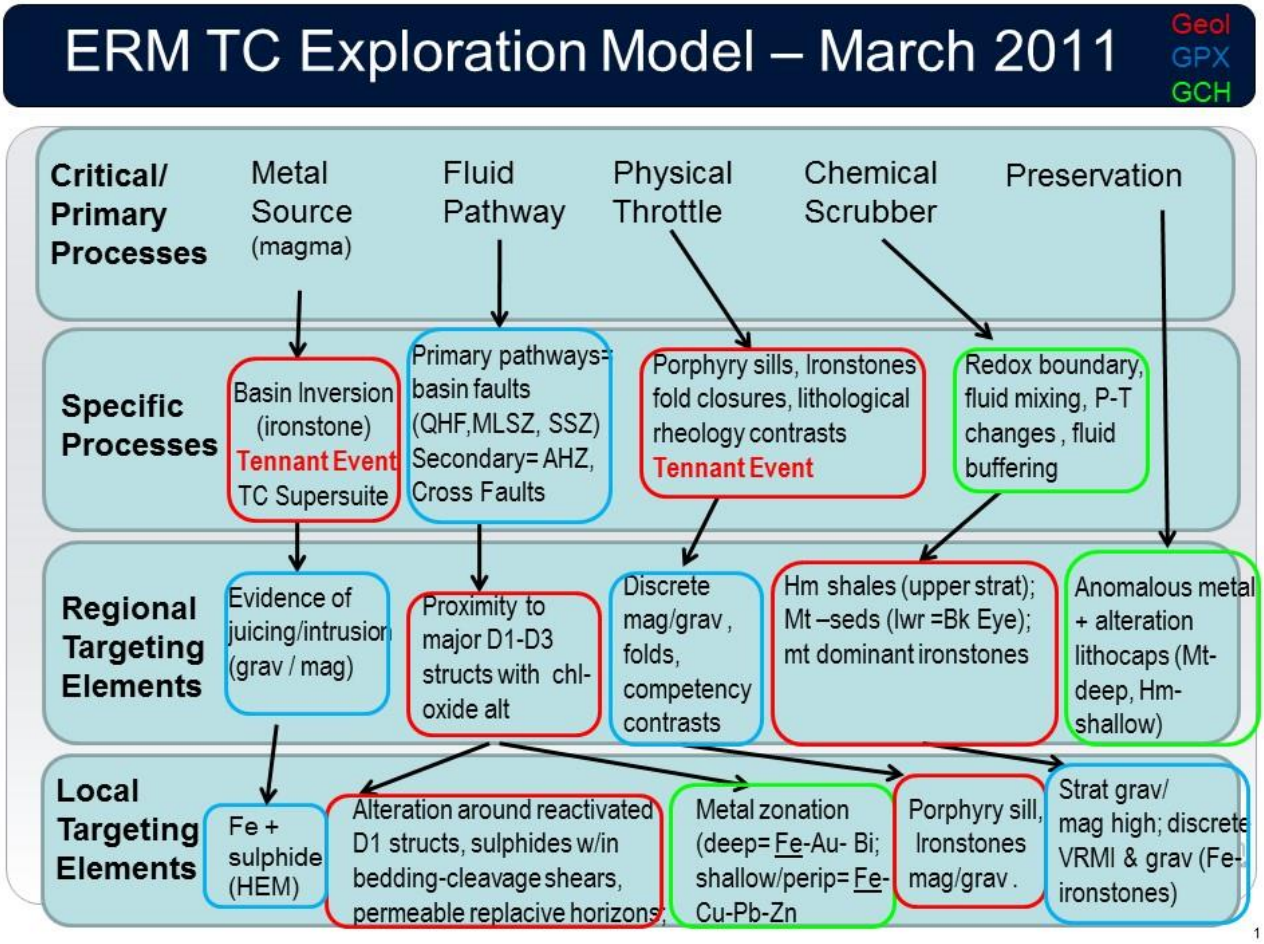

Figure 2 Emmerson Resources Exploration Model based on the concepts of Minerals Systems

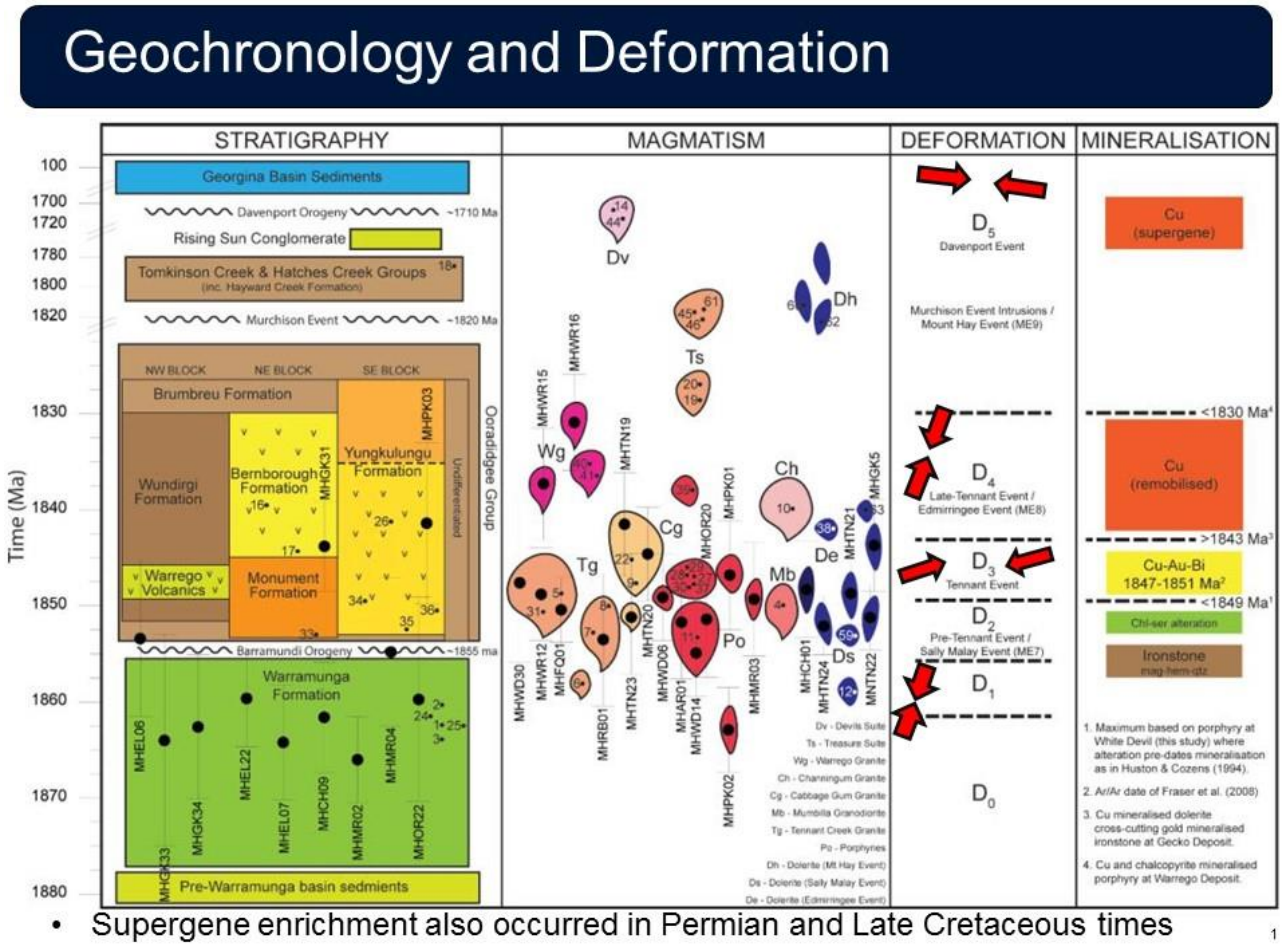

Figure 3 Tennant Creek Mineral Field Geochronology

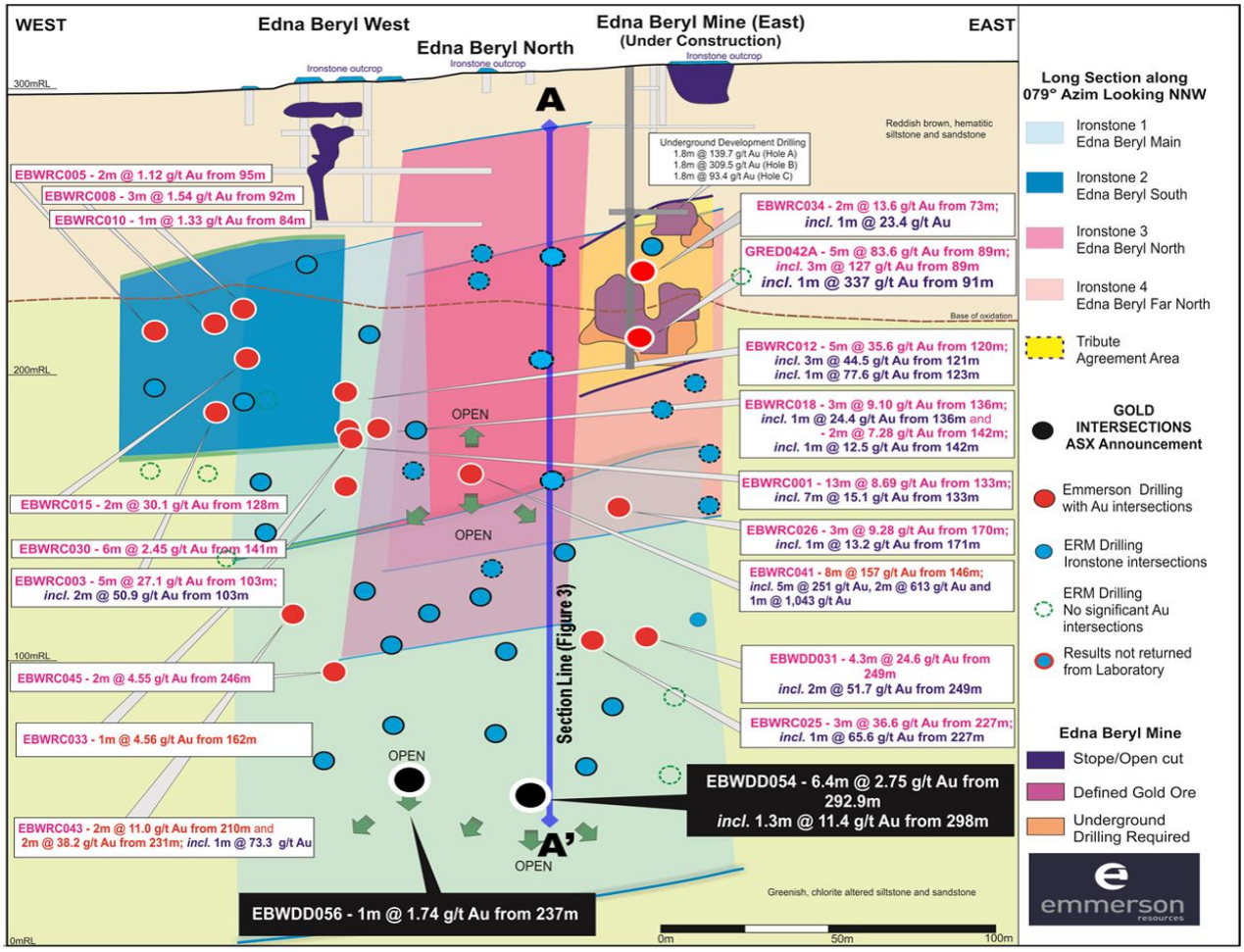

Figure 4 Long Section of the greater Edna Beryl Mineralisation