Collaborative Exploration Initiative:

CEI0040: The Millennium Project – Drilling for an Extension of the Century Zn-Pb-Ag Deposit

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1. Executive Summary

Century Mining Limited (a wholly owned subsidiary of ASX-listed New Century Resources Ltd) was successful in applying for CEI funding exploration drilling for a displaced part of the world-class Century Pb-Zn deposit. It is proposed that the Century orebody was significantly affected by an Ordovician meteorite impact and part of the original deposit may have slid towards, or into, the impact generated crater. The project to explore for an extension to Century, including this application, is referred to as 'the Millennium Project'.

Three RC/diamond drill holes, NCR014, NCR015 and NCR016, for a total of 1,599.1m, were completed. No ore-grade mineralisation was intersected, but several important findings resulted.

'Proof of Concept' was shown for large rafts of Century host rocks to have slumped into the Lawn Hill Impact Structure (LHIS). NCR014 intersected some 30m of Pmh4, albeit below the Century ore position, close to the base of impact-related slump sheets above the crater floor. The intersection demonstrates potential for Century mineralisation in an area of up to two square kilometres, more or less under the north waste rock dump.

The architecture of the crater is much better known with the three intersections. NCR016, the easternmost hole, appears to have drilled on the slope between the central crater dome and the ring syncline. This architecture constrains the area of potential for rafts hosting Century mineralisation.

Complex crater architecture appears to explain an apparent ridge intersected in NCR015, with a shallower than expected crater floor. Interpretation suggests an impact-related transpression ridge in this area, which is also likely responsible for the unusual position of the East Fault Block, surrounded by Cambrian carbonates and some distance above the Century deposit. Potential for shallow ore blocks or even large rafts with ore exists along this newly defined transpression ridge.

Our understanding of the meteorite impact and the effects on Century have dramatically improved with the three CEI holes. Ideas on the structure of the crater, and potential for more displaced Century ore, continue to evolve and are leading towards more drill targets.

2. Location & Land tenure

2.1. Location & Access

The Century Zinc-Lead-Silver mine is located in the remote lower Gulf region of northwest Queensland, approximately 250km north-west of Mount Isa.

Figure 1. Century Mine Queensland - Project Location

Access via road, from Cloncurry and Burketown respectively, consists in most part of sealed roads; whilst from Camooweal and Mount Isa roads remain unsealed. In both cases, roads transition to graded gravel roads to the mining lease boundary.

Access to the Century Mine is via existing mine infrastructure roads. Site roads consist of a mixture of sealed and graded gravel roads.

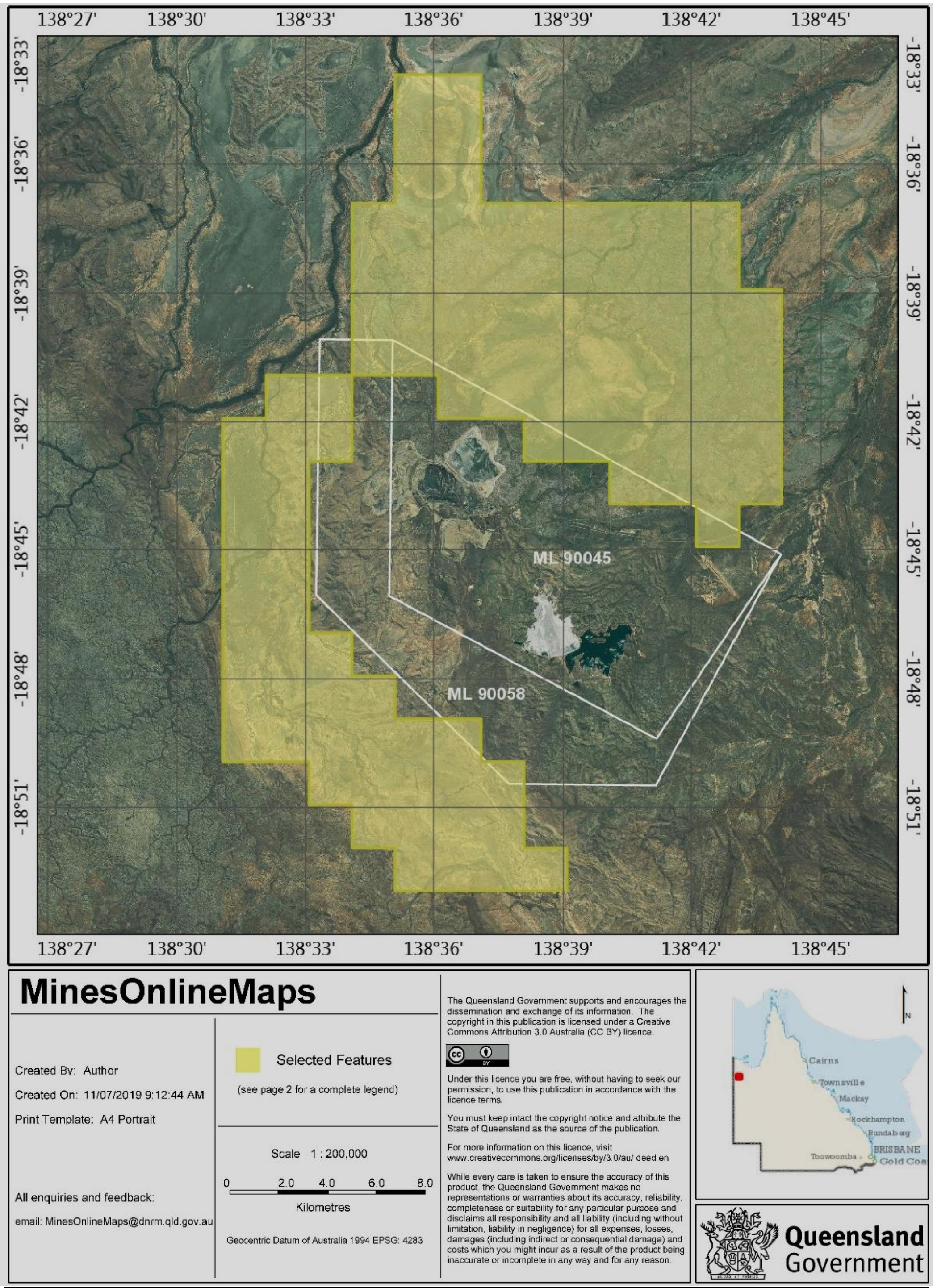
The mine also has an air strip that receives planes from local regional centres. The runway is 1748m long and capable of accommodating large aircraft.

2.2. **Mineral Tenement and land tenure**

The Century Mine lies within the mining lease ML90045 which is 100% owned by Century Mining Limited, a solely owned subsidiary of New Century Resources. The tenure of ML90045 is in good standing.

The Century Mine Exploration tenements and Mining Leases are managed by Tenement Administration Services Pty Ltd.

A list of all surrounding tenements held adjacent to the project is provided in Table 1.3 and shown graphically in Figure 2 over page.



Permit	Name	Status	Grant	Expiry Date	Area
ML90045	Century Mine	Granted	19/09/1997	18/09/2037	14,688 ha
ML90058	Century Mine	Granted	19/09/1997	18/09/2037	8,496 ha
EPM10544	Lawn Hill	Granted	23/06/1995	31/12/2019	102 sub-locks

Figure 2. Location of Century Mine Lease (white), and Exploration permit EPM10544 (yellow)

3. **Introduction**

The Century orebody is a world class Proterozoic stratabound shale hosted zinc-lead-silver deposit (Figure 1). It was discovered in 1990, mined for almost 20 years with a contained pre-mining resource of 118Mt at 10.2% Zn, 1.5% Pb and 36 g/t Ag (Waltho and Andrews, 1993). Mining ceased in 2015 and the mine was subsequently acquired by New Century Resources.

The deposit was formed at 1570±6Ma (Ord *et al*., 2002; after Carr *et al*., 1996), approximately 25 Ma after the host sediments (dated at 1595±6 Ma (Page *et al*., 2000)). The deposit lies adjacent to the Termite Range Fault (TRF), a crustal scale structure which is regarded as being the major controlling fluid conduit for the deposit (Broadbent *et al.*, 1998). Crustal scale faults are associated with other similar Proterozoic sedimented hosted deposits in northern Australia, such as the Mt Isa and McArthur River deposits (e.g. Large *et al*., 2005; Murphy *et al*., 2011).

There are two genetic models of the formation of Century, a stratabound replacement within a hydrocarbon-bearing shale-siltstone sequence, (Broadbent *et al*., 1998), or syngenetic mineralisation with subsequent remobilisation, (Feltrin *et al*., 2009). Notwithstanding these, the funding application is more concerned with post-mineralisation modification of the deposit by happenstance of its location on the edge of an Ordovician meteorite crater (see Lees et al. 2019).

The Century deposit is situated on the western margin of a ca. 18km diameter circular region which comprises an outer rim or "annulus" of highly disturbed Cambrian limestones and breccias surrounding a core of Proterozoic rocks, commonly exhibiting shock textures. This curious feature has been the subject of considerable debate, with conflicting ideas, since first mapped in 1968 (DeKeyser, 1969):

- Wilson and Hutton (1980) and more recently Feltrin and Oliver (2014) relate the Cambrian slumping and megabreccias in the annulus to sedimentary processes in a platformal setting. Feltrin and Oliver (2014) give a comprehensive description of the breccias, attributing the deformation to syn-sedimentary slumping, but acknowledging that a meteorite impact could not be completely discounted.

- Stewart and Mitchell (1987) identified shatter cones and melt rock in the crater centre consistent with its formation as a crater and suggested a Precambrian age for the impact. Shoemaker and Shoemaker (1998) interpreted it as a Precambrian impact, with the Cambrian limestone deposited inside the crater.

- Lindsay and Brasier (2006) described it as a Cambrian impact site, with limestone being deposited within the annulus. Salisbury *et al.* (2008) named it the Lawn Hill Impact Structure (LHIS), and suggested a Cambrian impact into semi-consolidated limestones, together with slumping into the crater, and dykes with Cambrian-sourced fragments injected into the Proterozoic basement being related to the impact. In addition, they reported melt rocks, shatter cones, planar deformation features (PDF's) in quartz and microdiamonds, making its interpretation as an impact site incontrovertible.

- Darlington *et al*. (2016) dated the melt rocks in the Proterozoic core as Ordovician (472 +/- 8 Ma; $^{40}Ar/^{39}Ar$) and interpreted the limestone as being in-situ and water saturated at the time of impact, with folding and internal breccias resulting from the impact.

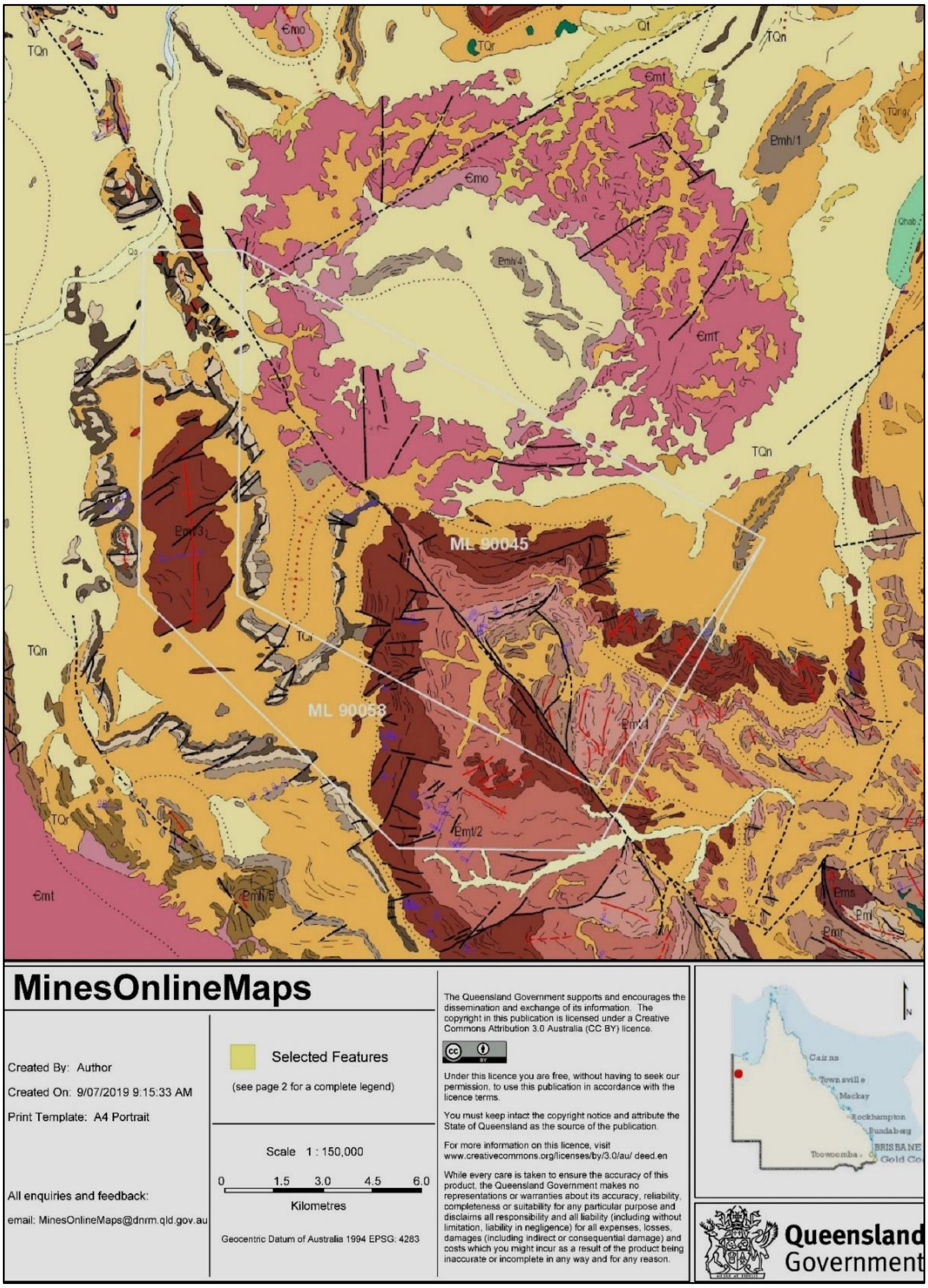


Figure 3. Geological elements of the Mt Isa inlier in the Lawn Hill region showing the project location, and clearly visible Lawn Hill Impact Structure (annulus). Proterozoic sequences (brown/orange), Cambrian carbonates (pink) and major structures (black), and the Mine Leases (white). Co-ords: Geographic WGS84.

Previous publications on the geology of Century seem to have given relatively little prominence to the juxtaposition of the crater with the orebody. Waltho and Andrews 1993; Broadbent *et al.,* 1998; Kelso *et al*., 2001, Broadbent *et al*., 2002, and O'Rourke *et al*., 2017 recognised the displaced Proterozoic rocks and their incorporation into the Cambrian as possible fault slices, chief amongst these being the East Fault Block orebody (Waltho and Andrews, 1993; Broadbent *et al*., 1998). However, the faulting was attributed to reactivations of the Termite Range Fault. O'Rourke *et al*. (2017) interpreted the structural architecture of the deposit as a negative (extensional) flower structure along the TRF, with some post-Cambrian modification of this architecture.

It is the nature of this post-Cambrian modification that is at issue here. Our interpretation is that during and after the impact event there was significant collapse "spalling" of the orebody at the edge of the crater, and this collapse was related to the impact and mostly un-related to the TRF. Our work has highlighted previously unrecognized rock relationships and textures at the mine that are indicative of suevite (French, 1998) and resurge deposits (Ormö *et al*., 2007) which we relate to the cratering process. A pre-impact fault restoration of the orebody is proposed which suggests a missing slab may have moved on a detachment towards, or perhaps into, the crater.

The new ideas presented here hold considerable exploration potential and could be of considerable economic importance for New Century Resources. Exploration based on the concept has begun with IP completed in mid-2018 and will continue. If this grant application is successful, it will allow three deep drill holes to explore for mineralisation, define the base of the crater, and understand the architecture of detached rafts in the crater. The Millennium Project has commenced with IP completed and planned (but is not the subject of this application); the company will also undertake ongoing exploration on the basis of the concepts presented here.

All images and co-ordinates are in GDA94, zone 54 unless otherwise stated.

4. **Regional Geology**

The Century deposit lies within the Lawn Hill Platform, part of the broader Western Fold Belt of the Mt Isa Inlier (Fig. 2). The Western Fold Belt comprises Proterozoic sediments of low metamorphic grade, dominated by sandstone (Torpedo Creek Quartzite), then carbonates in the lower part of the sequence (Gunpowder Creek Formation, Paradise Creek Formation, Esperanza Formation, Lady Loretta Formation), then clastics in the upper part (Shady Bore Quartzite, Riversleigh Siltstone, Termite Range Formation and Lawn Hill Formation (Scott *et al*., 1998; Southgate et al., 2000; Neumann *et al*., 2003; Fig. 3). The sequence ranges from c. 1665 Ma at the base to 1575 Ma at the top (Neumann *et al*., 2003), with sedimentation ceasing due to the onset of the protracted Isan Orogeny (Blake, 1987).

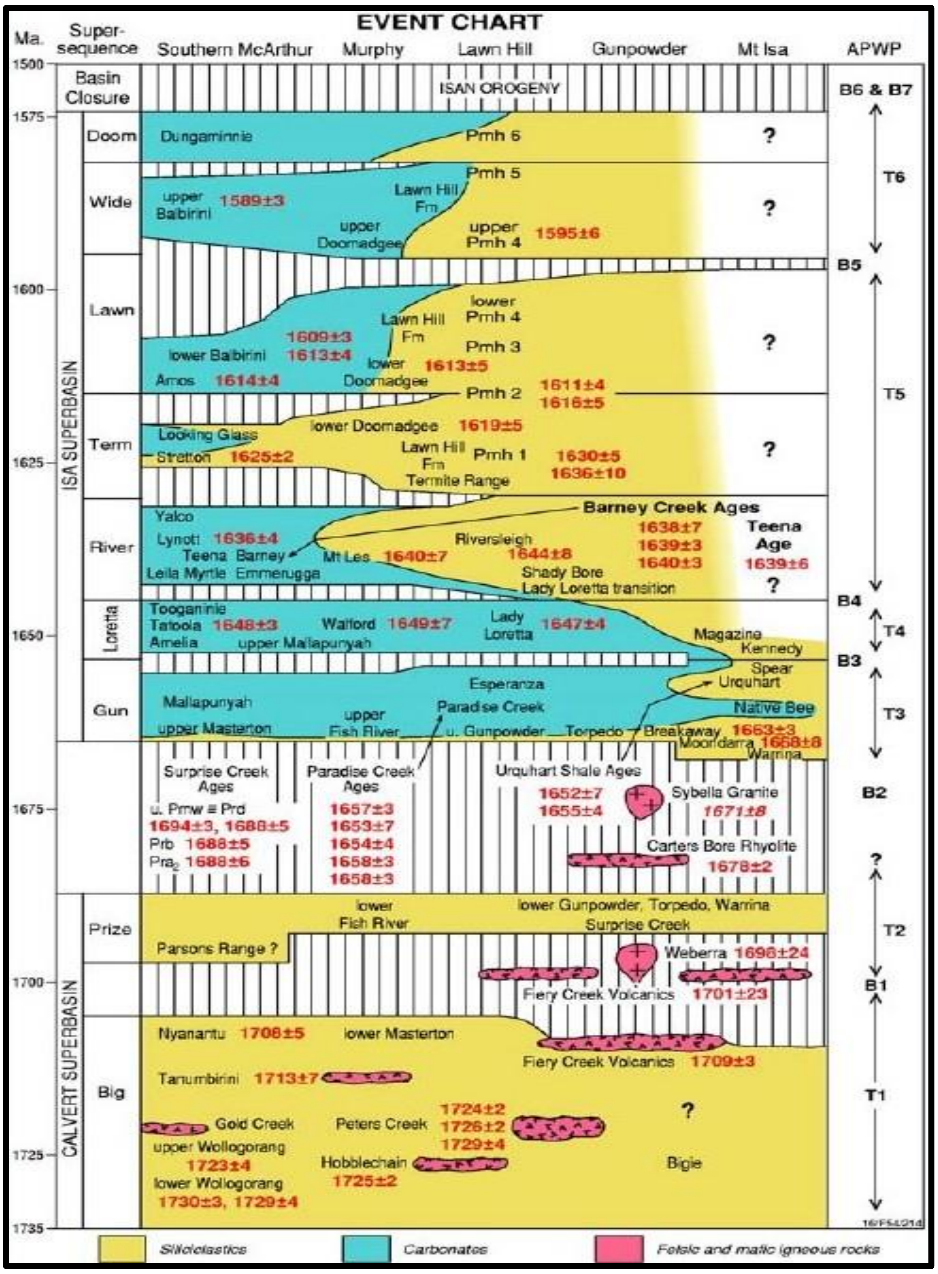


Figure 4. Event Chart for the Western Fold Belt (from Neumann *et al.,* 2003).

The sequences in the Western Fold Belt are thought to have undergone two episodes of folding during the Isan Orogeny. Major faults are up to hundreds of kilometres in strike length and include the Fish River Fault, Termite Range Fault, Mount Gordon Fault and Mount Isa Fault. Major mineralisation is closely associated with these faults; Walford Creek, Century, Capricorn (or Gunpowder / Mount Gordon) and Mount Isa-Hilton-George Fisher, are respectively associated with those faults.

Clastic sedimentation resumed in the western part of the area after the Isan Orogeny, with deposition of the South Nicholson Group, constrained to 1493Ma to 1400Ma (from Australian Stratigraphic Units Database). A significant break ensued, followed by deposition of Cambrian to Ordovician carbonate-dominated sediments in the Georgina Basin. In the Undilla sub-basin of northwest Queensland, the carbonate sequence is restricted to Templetonian to Undillan, or about 508 to 500 Ma (Smith et al., 2013).

4.1 **Century Deposit Geology**

Century has been subject to considerable work activities since its discovery and the architecture of the deposit is reasonably well constrained (refer descriptions by Waltho and Andrews, 1993, Broadbent *et al*., 1998; Broadbent and Waltho, 1998; Kelso *et al*., 2001; Large, 2001; Broadbent *et al*., 2002; Waltho *et al*., 1993; O'Rourke *et al*., 2017, amongst others).

The deposit lies within unit Pmh4 of the Lawn Hill Formation. The formation consists of several units (Sweet *et al*., 1982; Andrews, 1998): a lower thick carbonaceous shale unit Pmh1; a unit of tuff, tuffaceous siltstone, sandstone with minor shale, units Pmh2 and Pmh3 (Pmh2-3 of Andrews, 1998); a shale and siltstone unit, host to the deposit, and subdivided into a lower carbonaceous shale unit Pmh4r and upper shale-siltstone unit Pmh4s by Andrews (1998); a massive sandstone unit (the Widallion Sandstone), unit Pmh5; and finally, and confined to one or two locations, a siltstone – fine sandstone unit, Pmh6.

The stratabound zinc deposit is hosted in delicately laminated carbonaceous shales and siltstones of the upper part of the Lawn Hill Formation (unit Pmh4s, Hutton and Sweet, 1982; Andrews, 1998). It lies in the core a gentle north plunging, relatively open syncline (the Page Creek Syncline). Ore genesis is mostly accepted as epigenetic, related to replacement of a hydrocarbon-bearing reservoir through infiltration of metal-bearing fluids that were driven along the TRF (Broadbent *et al.,* 1998). The metal-bearing fluid was a basinal brine with c. 21% NaCl equiv. (Polito et al., 2006). In contrast, Feltrin *et al.,* 2009, proposed a syngenetic origin.

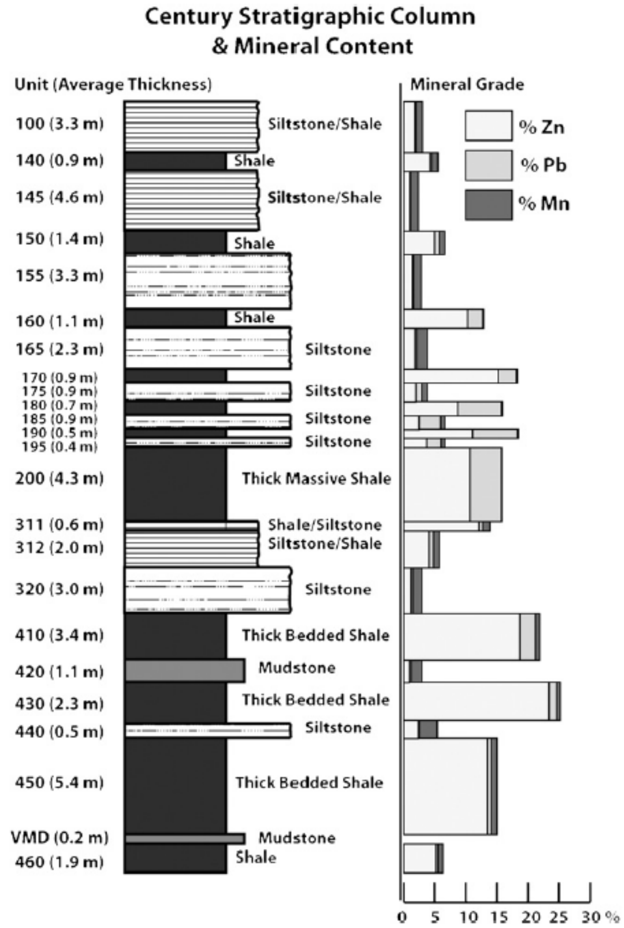


Figure 5. Mine stratigraphic column (Clifford and Kelso,2003), showing alternating shale, siltstone intervals and relative total deposit averaged concentrations in weight % for Zn-Pb-Mn.

A number of features in and around the orebody have been ascribed to the mineralising process. These included extensive siderite-(ankerite) alteration, stylolite development, removal or remobilisation of silica (Broadbent *et al.,* 1998).

Intriguingly, there are no “natural” terminations to the Century deposit, being truncated at an unconformity below the Cambrian limestones, and by post-ore faulting (Waltho and Andrews, 1993; Broadbent *et al*. 1998; Fig. 2). The northern and southern boundaries of the deposit are defined by post-ore, post-Cambrian faults (Nikki’s and Magazine Hill Faults, Fig. 2). These faults, along with the median Pandoras Fault, break the orebody into two main slabs, North and South Blocks. There is a small isolated ore block to the east, known as the East Fault Block (EFB) detached from the orebody and wholly contained within Cambrian limestones. In either case, through erosion and faulting, the original orebody was once larger than what has been so far discovered (Waltho and Andrews, 1993). What ore has been lost by either process has not been established. Broadbent *et al.* (1998) speculate the deposit might have been two or three times its present size.

We believe that the nature of the sub-Cambrian unconformity has not been properly interpreted, and we present evidence that this position is occupied by Ordovician suevite, that is, ejector material from the impact. In turn, we present evidence of slumping of Cambrian and Proterozoic material over the ejector blanket and infilling the crater.

West of Century, in the Constance Range, the Neoproterozoic South Nicholson Group is overlain by Cambrian limestones of the Georgina Basin. The basal contact of the Cambrian is a regionally extensive unconformity at an elevation of 200-220m, dipping gently west, and not folded. It includes a distinctive basal unit of nodular, phosphatic, cherty limestones, called the Border Waterhole Formation (some tens of meters thick), an important marker unit with a type section in the west (Southgate, 1988).

A circular outlier of Cambrian limestones occurs immediately east of Century mine, in the Gumhole Plain, at an elevation of 135m, and another smaller area lies to the north at Mt Jennifer, about 2km outside of the interpreted crater edge (Figs. 1 and 2).

The Border Waterhole Formation, the basal unit of the Thorntonia Limestone, is mapped in both these areas, forming the inner rim to the Cambrian annulus, for the most part, and at the base of Mt Jennifer in a gentle south plunging syncline.

The interpreted sub-Cambrian unconformity in the Century area (Broadbent *et al*., 1998) comprises a basal grit resting on weathered haematised Proterozoic shales. The grit appears to be unique to the Century region. We are interpreting this basal grit as a suevite breccia resulting from the Ordovician meteorite impact. The Border Waterhole Formation is not identified in the vicinity of the supposed unconformity at Century.

The basal grit is encountered in and around the mine and in multiple drill holes in the surrounding area, and is It is texturally distinct from the Border Waterhole Formation in being a non-phosphatic, non-carbonate breccia and more variable in composition. Overlying the grit are Cambrian limestones, massive, bedded and with internally brecciated units. They are considerably disturbed, as seen by widely varying bedding orientations (Fig. 4). These rocks overlie the grit typically on low-angle detachment faults. (Note: Ordovician suevite may also occur on top of the Cambrian limestone, creating a stratigraphy complicated by shallow detachments so that it appears in both reverse and normal order).

The Proterozoic rocks at Century contain downward penetrating carbonate breccia dykes that were derived from the overlying Cambrian limestones. These are injection breccias which Salisbury *et al.* (2008) and Darlington *et al*. (2016) relate to impact phenomena. This is in contrast to Broadbent *et al*., 2002, who regard these as Neptunian dykes. The distribution of these dykes within the Proterozoic is complex (Feltrin and Oliver, 2014).

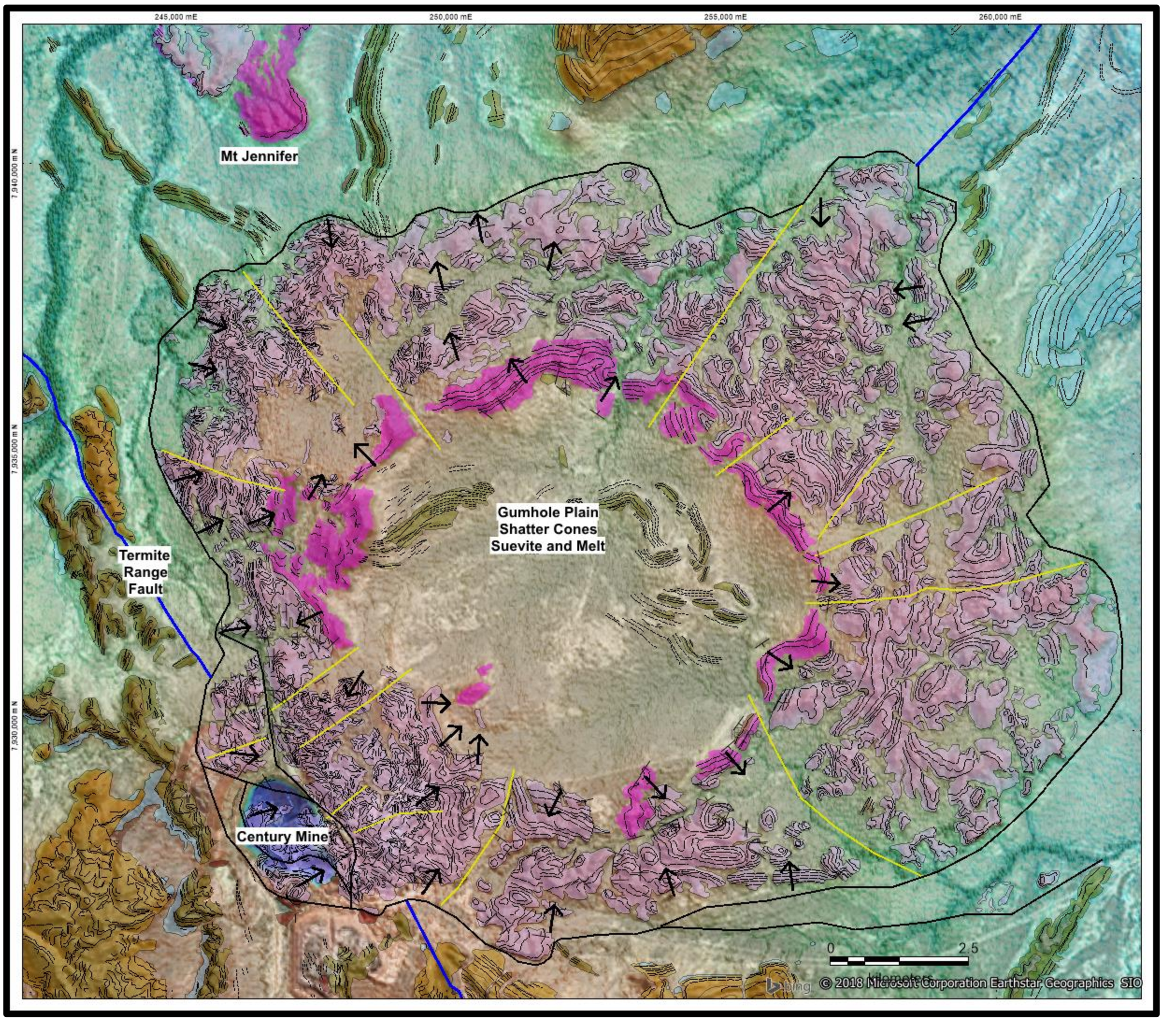


Figure 6. Local geology of Century area. The annulus is clearly visible, with Gumhole Plain in the central resurgent dome. Bedding trends (faint black lines), Termite Range Fault (blue); crater-related faults and detachments (black). Arrows in the limestone represent generalised dip directions. Border Waterhole Formation (maroon), Cambrian limestone (mauve); post-crater, perhaps radial, fractures (yellow lines). Background is false-colour digital elevation image.

4.2 The Lawn Hill Impact Structure (LHIS)

Several diagnostic criteria confirm that the LHIS is a complex crater, with a central uplift containing melt rock, shatter cones and microdiamonds (Salisbury *et al.* 2008). Other criteria present at the LHIS that aid in diagnosis of an astrobleme include roughly circular shape, central domal structure, downward-penetrating dykes of younger rocks, and now, suevite breccia and spherules.

The impactor is thought to have excavated a crater 18km in diameter (Salisbury *et al*., 2008), although this marks the outer limit of collapse into the crater. Koeberl and Sharpton (2018) derived a depth to diameter ratio of 0.10-0.20 for large terrestrial impacts; based on that range, the depth of the crater may have been 1.8-3.2km. However, we know from reconstructions at Century, that the Magazine Hill Fault, which marks the outer edge of collapse into the crater, was outside the initial crater (as the rocks beneath the fault have not suffered impact damage); this implies the crater diameter was in the order of 10-14km, which in turn suggests an initial crater depth of 1.0-2.8km. A Ukrainian impact with a diameter of 18km, described by Gorov *et al*. (2009), appears to have had an initial crater depth of 500-600m, including an impact layer up to 150m thick. There has undoubtably been significant erosion of the LHIS since the Ordovician impact, perhaps in the order of several hundred metres. We suggest the crater was so modified by the spalling that the original size of the crater is within the limits suggested above; viz. 10-14km diameter, and current maximum depth of 0.5-2.4km.

Impacts typically result in an ejector blanket of suevite (French, 1998), with attendant slumping of the crater walls. Suevite breccias range in texture and composition depending on the source material, degree of melt incorporation and transport distance (French, 1998). Flow banded textures in more glassy suevites and melts (tagamites) are well described (Masaitis, 2005), while dropstones and clasts with spalled edges are also indicative (Rappenglück *et al*., 2004). “Resurge deposits” is also a term to describe these deposits, where impacts effect a water column (Ormö *et al*., 2007). Without direct evidence for melt (spherules, tagamite) and shock metamorphic effects such as planar deformation fabrics (PDFs), there are a wide range of possible origins (excluding volcanic input in this instance) such as debris flows, glacial tills and fluidised breccias (e.g. Reynolds, 1954; Murphy, 1984).

There are several types of breccias in the Century area, some related to the Ordovician impact and some not. Salisbury *et al.* (2008), suggest that some breccias within the Cambrian carbonates are suevite, and we do not agree. We interpret these as intraformational and solution-collapse breccias, inherent to the Cambrian stratigraphy, in agreement with Southgate, 1988 and Feltrin and Oliver, 2014.

Given the Ordovician age of the impact and lack of shock features in the slumped Cambrian in the crater, the physical state of these rocks (assuming they were in place at the time of impact) has been regarded as semi-consolidated, water saturated sediments (Salisbury *et al*., 2008; Darlington *et al*., 2016) which have absorbed and not transmitted shock waves thereby lacking melting or shock textures. Whether these were at surface or under water at the time of Ordovician impact remains unclear. The coherence of some slump sheets and large-scale folding suggests a moderately well consolidated sequence. Our interpretation is that the Cambrian that currently resides in the crater was slumped into place from nearby regions as a partially consolidated to locally lithified mass soon after the crater formed.

Other than the slumped rafts of Cambrian limestone, there is little documented evidence for spalling or caving of other material on the edge of the LHIS crater. The out-of-position East Fault Block orebody was interpreted by Salisbury *et al.* (2008) as resulting from the impact, rather than due to faulting along the TRF. We concur with this interpretation. Compared to impacts of similar dimensions, crater walls show rotational slump faults that is likely to migrate outwards to incorporate material formerly outboard of the initial margins of the crater.

The resurgent dome of the crater is defined by strongly deformed Proterozoic sequences (likely to be Pmh2-3; possibly also Pmh4), surrounded by Cambrian limestones in the annulus. In a few places, the contact is preserved and appears to be a fault; there is no suevite of the ejecta blanket at these locations; extensive alluvial cover in Gumhole Plain prevents further analysis.

4.2.1 Suevite Breccia Distribution and Textures

Although not directly related to the CEI, additional field mapping was undertaken during the drilling program, with some surprising results.

Outcrops of probable suevite breccia have now been mapped around the western and southern margin of the LHIS for at least 15 strike kilometers (Fig. 5), as well as in the Century open pit. The suevite is “probable” as to be certain it is, evidence of former meteorite melt should be in the rock, and petrography has been done so far to show this; however, textures in some of the outcrops, especially at the Proterozoic unconformity in the Page Creek diversion and the MAC diversion channel, have features definitive of an impact-related origin.

These suevite breccias typically have silicified Cambrian carbonate clasts (rarely Proterozoic clasts except for basal units where locally abundant) in a ferruginous matrix. Some evidence of lateralization complicates the interpretation of these breccias. The breccias appear to have two distinct habitats:

1. Demonstrably (in some cases) uncomformably overlying Proterozoic bedrock, ranging from Termite Range Formation up to at least Pmh4 and perhaps Pmh5, and grading from basal surge and bedded breccias up into massive debris flows, sometimes with megaclasts, in a matrix that can be a mixture of iron, clay and silica;

2. Breccias within the Cambrian carbonate sequence, of with knife-sharp contacts with underlying and overlying Cambrian; it should be noted these breccias are quite different from the carbonate-matrixed breccias derived from the Cambrian carbonates as sills, dykes and other ‘intrusions’. These ferruginous breccias are interpreted as suevite intrusions related to the impact (see Fig. 7). Given that interpretation, these breccias must have been close to the crater rim at the time of impact.

The position of these suevite breccias we now believe to mark the rim of the apparent crater (i.e. the crater in its’ final form with domal uplift). The apparent crater rim is in places defined by the suevite, and separates Proterozoic from thick, rafted Cambrian carbonates, plus or minus rafts of detached Proterozoic.

At the Page Creek diversion channel (Fig. 7), the gentle north dipping, deeply weathered Proterozoic shales are overlain by distinctive grits and conglomerates that are dipping north at a shallower angle than the basement. At their base, these comprise hematitic “shale flake breccias” derived from the underlying Proterozoic. The transition from basement into the grit is a narrow zone (10cm thick) of disaggregated shale fragments with ragged clast edges and jigsaw fit rotations (Fig. 7). These breccias fine upwards into gritty sandstones and conglomerates over an interval of 1 to 5m (Fig. 7). This includes a laminated more clay rich layer (50cm thick) with a streaked, welded appearance which contains angular and subrounded clasts of lithified Cambrian limestone and chert. Several of these clasts show dropstone textures (Fig. 7). An origin as explosive fall out material (suevite) from the crater is proposed.

Overlying this is a chert-rich breccia with angular clasts and jigsaw fits which suggest some in-situ fragmentation in a rock flour matrix. Included are clasts of rounded cherty limestone that display open fractures and truncated flat edges (Fig. 6). These are interpreted as spall fractures, related to tensional fracturing immediately post the compressional impact.

The chert breccia is overlain by and interfingers with rounded quartzite cobble conglomerate beds. The conglomerates appear to occupy fluvial channels with a clast content dominated by sandstones from Proterozoic units, often with a desert varnish. Above these to the north are massive slump-bedded Cambrian limestones. The fact that the basal breccias contain clasts of the structurally overlying Cambrian material confirms the interpretation of this section as an inverted stratigraphy.

A series of breccias overlying the Cambrian limestones along the north wall of the mine, north of Nikki's Fault (Fig. 6). This unit overlies the Cambrian limestones and shows complex relationships of rafted Cambrian limestones and intraformational breccias within interpreted suevite breccias and overlain by or interfingering with fluvial channel fills. Clasts of the intraformational limestone breccias are incorporated into the more chaotic, unsorted and poorly consolidated suevite breccias. Some aspects of these breccias resemble karst fill breccias and there may a karst component; however, the extent (1km strike section of the pit wall), textures and thickness (up to 100m) indicates these are dominantly suevite breccias described elsewhere in the literature (French, 1998; Masaitis, 2005).

Overlying the suevite breccias on the north pit wall and in the Page Creek diversion is a cobble conglomerate (Fig. 6), composed mainly of well-rounded clasts of Precambrian sandstone, often coated with desert varnish. In the pit wall, the relationship is gradational, but the conglomerate is also present in what appears to be channels within the suevite. A steep syn-depositional fault imposes a weak fabric on the suevite and conglomerate, implying some local post-depositional structuring. Gradational from suevite to conglomerate is also observed. We interpret the conglomerate as Ordovician, formed post-impact by streams flowing in to the crater.

The distribution and thickness of the basal grit / suevite in the Century mine area has been evaluated from historic logging of drill core. These intersections have been partially verified by the authors. There is an uneven distribution in detail which is considered in part due to inconsistent logging. In places, it is absent possibly due to it being over-ridden by Cambrian rafts. Notwithstanding this, there is a relatively consistent ejector blanket, up to 10m thick.

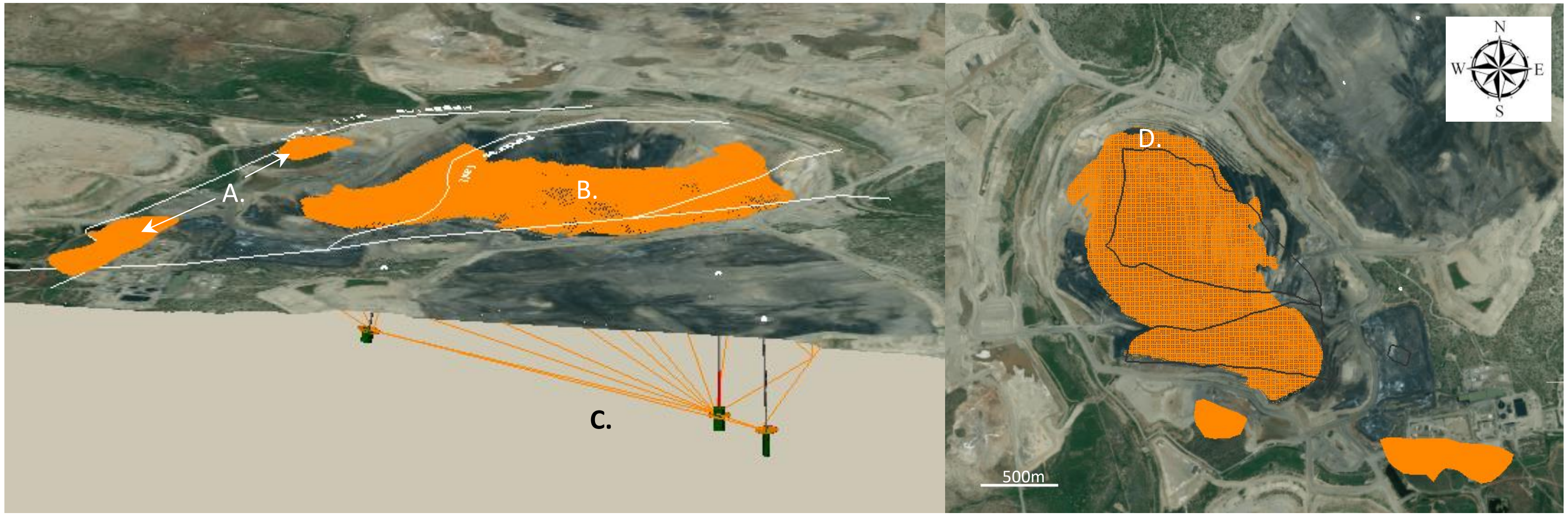


Figure 7. Distribution of suevite: **A.** Recent field mapping of suevite in outcrop; **B**. Suevite 'blanket' across orebody in historic drilling; **C**. Suevite in deep drilling; **D.** Cross-section location for Fig. 8.   The suevite is now known to be a mantling sedimentary breccia.

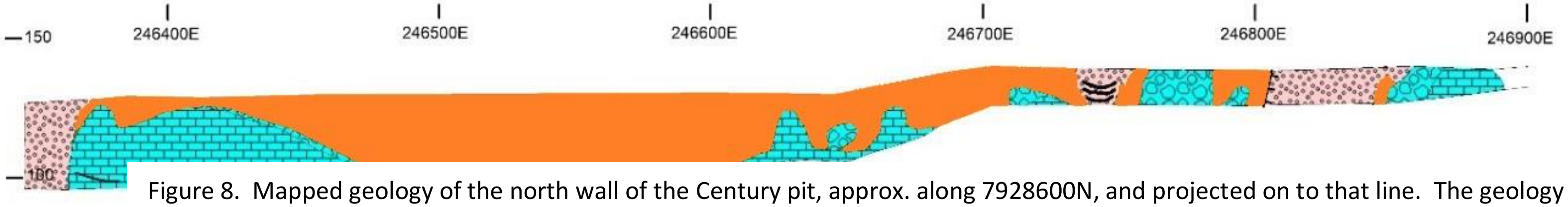


Figure 8. Mapped geology of the north wall of the Century pit, approx. along 7928600N, and projected on to that line. The geology is complex; massive Cambrian limestone is variably disrupted becoming a breccia; suevite overlies and has some gradational contacts with conglomerate.

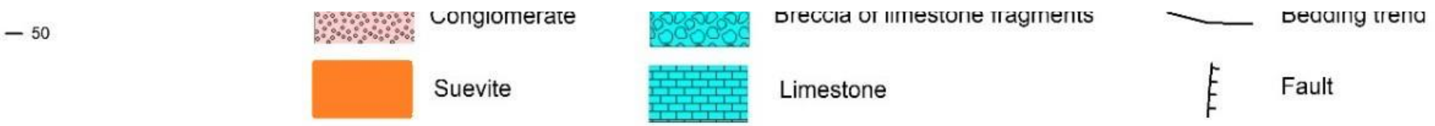


Figure 9. A: Page Creek diversion channel showing contact of weathered Proterozoic (A), overlain by basal grits (B) and cobble conglomerates (C). B: the same area (looking west) with same units A, B, C. C: dropstone horizon of Cambrian clasts within the basal suevite grits. D: drill hole LH234, 138.0m, with graded shale flake breccias (scene 6.3cm across). E: spall fractures in rounded Cambrian clast in angular chert breccia in Page Creek diversion channel. F: North pit wall breccias, with intraformational Cambrian breccia clast in less consolidated, weathered suevite breccia. G: North pit wall, interpreted Ordovician fluvial conglomerate channel fill material (from Lees et al. 2019).

4.2.2 Pre-Cambrian Faulting near the Century Orebody

The Termite Range Fault is a north-west striking fault up to 300km long, dipping at around 60 degrees to the southwest, with mainly dextral movement and some dip-slip component. This, along with many other faults of diverse orientations, are perceived as fluid conduits for mineralising fluids (eg. Broadbent *et al.*, 1998) and commonly contain vein quartz with base-metal mineralisation ranging from traces to high grade. These quartz-filled faults form a reidel-like array supportive of brittle failure in a dextral strike-slip regime.

The Precambrian fault array does not appear to have been significantly reactivated during the Ordovician event. The Palaeozoic faults have a quite different structural style, as described below.

4.2.3 Post-Cambrian faulting of the Century Orebody

The Century orebody is cut by a series of post-Cambrian, largely extensional faults (Waltho and Andrews, 1993; Broadbent *et al*., 1998; Broadbent *et al*., 2002; Feltrin *et al*., 2009). This complex fault network cuts both the Proterozoic and Cambrian strata. The faults range from thin clay-rich shears to wide breccias which are dominantly carbonate sourced but locally contain clasts of Proterozoic rocks derived from hanging wall, ore zone and footwall units. A dog-leg cross section is shown in Figs. 8 and 9, which illustrate this complexity; multiple detached rafts are floored by faults, which are described further below.

Close to the Century deposit (Fig. 9), the fault boundaries are the Magazine Hill Fault, a major north dipping listric fault at its southern end, while Nikki's Fault at the northern end is a subvertical to south (and north) dipping fault with a complex geometry. The orebody is broken up internally into Northern and Southern blocks by the E-W trending Pandoras Fault. This has been described as a 'north dipping scissor fault' with a large displacement gradient along it, pinned in the east with near zero displacement increasing to 500m dip displacement in the west. This indicates rotational block movement towards the northeast and east, i.e. towards the crater.

The Magazine Hill Fault is known from drilling and a few surface exposures, and can now be traced for several kilometres. On several sections, a minimum dip-slip movement of 400m, but possibly up to 700m, is indicated. It appears to be a major detachment surface, with a variable usually shallow dip towards the LHIS, and may (at least in the mine area) define the outer-most major detachment surface - one of a linked set dipping into the crater.

Within the Century mine area, there are large, up to kilometer-scale rafts of Cambrian and Proterozoic stratigraphy that have been moved from their original positions due to landslide activity following the creation of the crater. The Magazine Fault is a major detachment now thought to link with similar structures around the margin, but outside, the original crater. The South Block lies on the detached slab, which is overlain by the scissor-like Pandoras Fault, which underlies the North Block. A series of smaller but still significant low angle detachments, including Prosperity Fault and various splays, and Gecko Fault, define several rafts of dominantly Cambrian limestone, but with locally large (km-scale) slabs of Proterozoic rocks. These rafts lie atop the North Block, and appear to have overridden this, coming from further outboard of the collapsing crater.

The Eastern Fault Block orebody (EFB) is detached from the main orebody and is enclosed by Cambrian limestones and breccias. The East Fault block has been variably explained by a complex interaction of faults and/or impact induced uplift, resulting in the dislocation and vertical displacement from the main orebody. This is the largest known piece of the orebody which is physically detached from the two main ore blocks. In addition, blocks of ore, footwall and hanging wall are incorporated into rafted Cambrian immediately above the main detached ore blocks.

Nikkis Fault is a complex, variably oriented zone, of variable width, with conflicting movement indicators; the suevite marker suggests south-side-up, while the Proterozoic sequence suggests north-side-up. Nikkis Fault is interpreted as a contact between rafts of different provenance; albeit they may have proximal sources. Nikkis Fault swings from a near east-west orientation and is likely to link to the East Slab Fault, a wide fault breccia of clay-hematite altered carbonate clasts in clay.

Beyond the near-mine environment, the architecture of various rafts which have slid into the crater, is poorly defined.

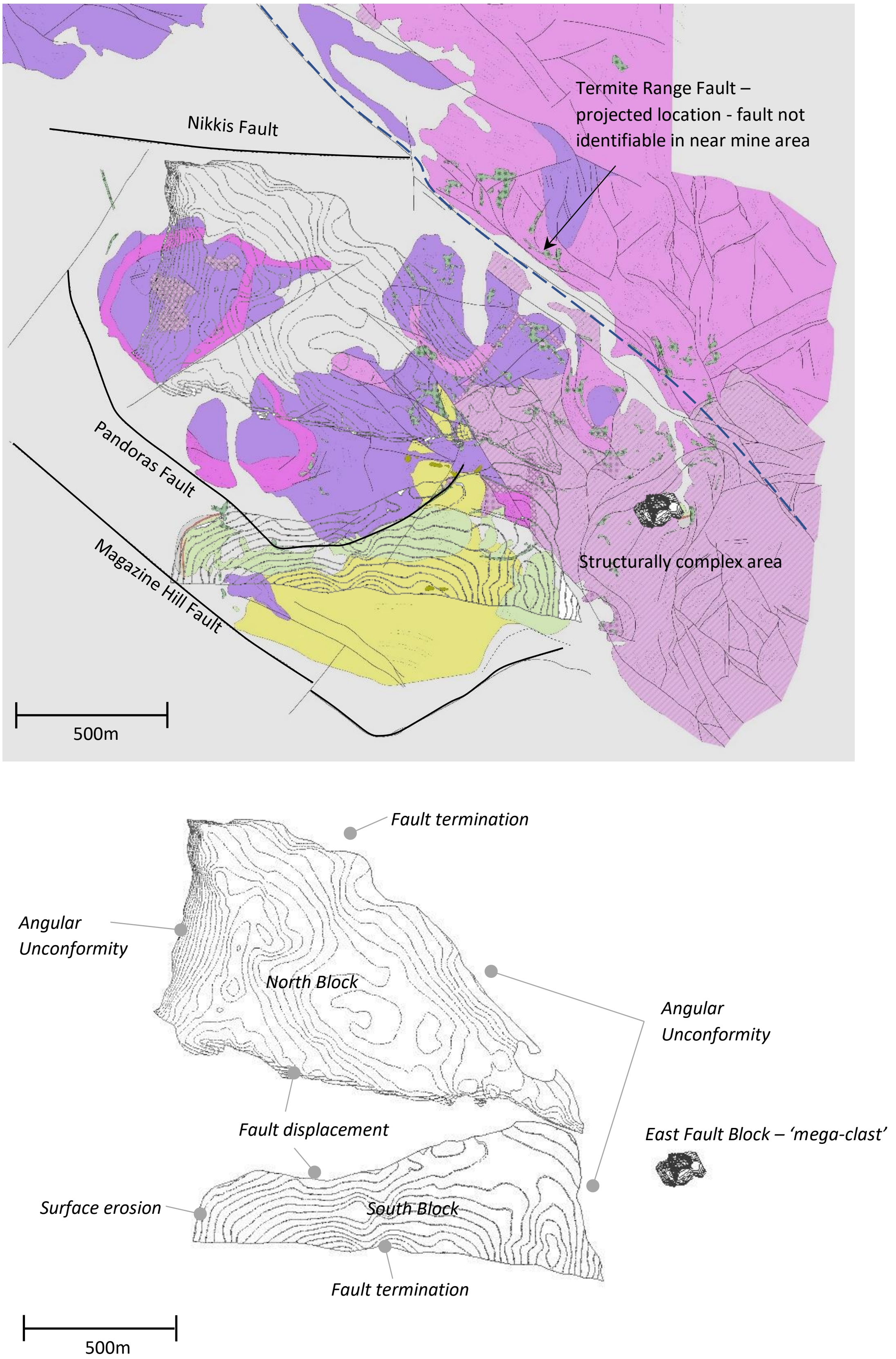


Figure 10. Century Surface Geology, Major Structures and Orebody terminations

5. Previous Exploration

A significant historic dataset of geochemical and geophysical data is associated with the Century Deposit, and adjacent Exploration Tenements.

Both technical and economic constraints in the past have limited the vast majority of data to a maximum depth of 300m from surface.

Data relevant to this submission is outlined in the following section.

5.1 Drilling

The target area, based on the geology described in the following section, is to the north and east of the Century mine (Fig. 14).

Extensive drilling in the near-mine area decreases markedly beyond 500m from the mine. A large part of the target area is untested, a small proportion is tested to >300m, only a few holes test to 400m, and one (LH370), to >500m.

LH370 (Table 1) intersected Cambrian carbonates down to 490m and includes multiple Proterozoic rafts within.

Based on the interpretation of this hole the potential for rafts containing mineralisation is down to at least 500m in this area. Given that, LH370 represents the only effective drill test in the target area for an extension of the Century deposit.

From (m)	To (m)	Geology
0	165.0	Cambrian limestone
165.0	192.0	Fault; breccia with fragments of Cambrian limestone
192.0	272.5	Cambrian limestone
272.5	279.0	Fault; breccia with fragments of Cambrian limestone
279.0	385.0	Cambrian limestone
385.0	389.0	Breccia of hematite-altered fragments; possible suevite
389.0	395.5	Hematite-altered (weathered) siltstone, Pmh4
395.5	429.0	Siltstone; Pmh4 Lower Footwall
429.0	432.0	Black carbonaceous shale; Pmh4 Lower Footwall; faulted contact
432.0	435.5	Breccia of hematite-altered fragments; possible suevite
435.5	489.8	Nodular Cambrian limestone
489.8	490.5	Fault: sericite-altered, possible shear zone
490.5	493.5	Breccia, bleached, leached, possible suevite
493.5	534.0	Interbedded sandstone-siltstone-shale; Pmh2-3
534.0		EOH

Table 1. Summary Log of LH370 (from photos and selective core examination).

5.2 Induced Polarization (IP) Geophysical Surveys

Historical IP was completed by CRA in 1990-91 and 1995-96. Re-assessment of this data by New Century's geophysical consultant indicates the 1990-91 data is of little use, while the 1995-96 data was surveyed with 100m dipole spacing and was ineffective at testing at depths below 200m.

Historical IP surveys were generally focussed on detecting relatively shallow mineralisation and most surveys used 100m dipoles in a dipole-dipole configuration. Although some of the historical IP surveys did cross the outcropping Cambrian limestone, the expected thickness of the limestone may have prevented the detection of mineralisation beneath it.

In 2018 New Century Resources carried out an updated survey targeting the crater area adjacent to the mine. The survey used longer dipoles and focused on the area of the outcropping limestone. Lines were extended beyond the outcrop limits in order to try to detect targets at depth – including the base of limestone.

In total 12 lines were surveyed with most lines were surveyed with 200m receiver dipoles and 200m or 400m transmitter dipoles. Subsequently, adjacent receiver dipoles were also summed giving 400m receiver dipoles to achieve greater depth penetration.

The survey aimed to define the near mine crater architecture, including the base of limestone, with the potential to identify high potential targets for displaced mineralisation.

Figure 11. Induced Polarisation (IP) line locations - 2018 Geophysical Survey.

5.3 **Geology**

Surface geology in the annulus and specifically the target area, is dominated by the Cambrian carbonates. Their deformation, typically broad-scale but incoherent folding with some faults including extensional tears, has been enigmatic, but can now be explained in the context of the well-documented LHIS. The deformation in the carbonates is only part of the picture as the folding is largely within detached rafts; the complexity of multiple rafts, each floored by a detachment fault, can only be defined using a drill hole database and extending the geology established in the mine area towards the crater.

The geology of the Century mine is best recorded in serial cross-sections N-S and E-W across the Century deposit, at 50m spacings, generated by S. King of Solid Geology (consultant for various companies at Century). This work has been an important contribution allowing reinterpretation of the post-mineralisation events.

6. **Detail of Target**

6.1 **Introduction**

The concept of this target is new and innovative, being generated by the authors while working for New Century Resources. The target is part of the original (in this case, pre-Ordovician impact) Century deposit, on a detached raft, which collapsed into the crater created by the Ordovician impact.

Some assumptions have been made:

- Deposit was formed with the Termite Range Fault (TRF) being the major feeder channel, and originally formed in the gap between the TRF and restored segments of the Century deposit;
- The missing part of the deposit was not eroded during the interval from post-ore formation to deposition of the Cambrian limestone sequence;
- The part of the deposit in the missing gap was not significantly destroyed by the Ordovician impact;
- Collapse of the crater wall is directed towards the deeper part of the crater. This gives a vector for movement of a detached slab - hence a target area north and east of Century.

6.2 **Deposit model**

In this case, the deposit style is well-known: the target is a missing part of the Century deposit. Century has been well documented (e.g. Waltho and Andrews 1993; Broadbent *et al*., 1998; Broadbent *et al*., 2002; Feltrin *et al*., 2009). It is not envisaged that any new deposit would be significantly different from the known and largely mined out deposit.

Key features of the deposit are:

- A sphalerite-dominated and pyrite-poor mineral system, with abundant (but subtle) siderite-(ankerite) alteration;
- Subdued response in surface geochemistry, and lack of a gossan;

- An IP response coincident with the deposit (Oldenburg *et al*., 1998), with a poor response to other geophysical techniques.

Despite the volume of previous work, it is the understanding of the post-mineralisation re-structuring of the deposit that is of interest here, and the re-interpretation of that structure that has led to the development of the possibility of an as-yet undiscovered part of the Century deposit. The model and supporting science are discussed elsewhere in this document.

6.3 **Targeting Criteria**

Reconstructions of the hypothesized pre-impact ore-body by Lees et al. (2019) suggest the original body to be >200Mt with the weathered and potentially dislocated portions representing up to 90Mt of >10% Zn+Pb mineralised Proterozoic siltstones and shales. This value is based on the surface area and average orebody thickness of the Century deposit reported from the Mineral Resource block voxel model used during mining operations.

The target mineralisation may exhibit as a cohesive slump block disconnected from the main orebody (analogous in size and grade to the Century South Block), or alternatively multiple smaller raft blocks such as the East Fault block (<1Mt).

The company believes a deep discovery as small as 10Mt in the target area, and down to 700m, or a shallow target as small as 0.5Mt has potential for economic extraction in the context of proximity to the current operating infrastructure (including mill and slurry pipeline); the known metallurgy, and locality within a granted Mining Lease.

Targeting criteria consist of:

- The conceptual model of a meteorite-related re-structuring of Century, described previously in this document, and assuming movement of the missing part of Century toward the deeper part of the crater during gravitational collapse;
- The drill hole database, which shows only one effective test below 500m in the target area of 21 sq. km.;
- IP, from the 2018 near mine survey targeting the crater;
- Surface outcrop mapping and interpretation;
- Detailed 3D structural and stratigraphic models from mining operations.

It is also important to note that, due to the depth of target at >250m, the amount of relevant data (effective drill holes; geophysics), is minimal even proximal to the deposit.

Drill density further decreases on the eastern side of the Termite Range Fault. The Termite Range fault is considered to be the mineralising structure for Century constraining historical targeting to the hangingwall in the West. Under the proposed model of structural modification of the orebody, targets are not constrained by the pre-existing fault location, but instead defined by the cratering process.

7. Targeting Model Development

7.1 Reconstruction of the Century Deposit

The final location of the Century deposit is not where the deposit formed, prior to the detachment faults related to the LHIS. The reconstruction relies on contacts and marker units within the well-known and documented mine stratigraphy. Restoration of the Ordovician Magazine Hill and Pandoras Faults translates the Century deposit some 700m to the south-west. Moving Century ~700m to the southwest creates a gap between where the deposit was prior to the impact event, (and, it is assumed, where it formed) and the Termite Range Fault, which is (amongst other related faults), arguably the main fluid conduit for ore-forming fluids.

A raft of Proterozoic with or without Cambrian limestone, from this missing ~700m gap, is thought to have slid toward the crater, and logically would have moved before or at the same time as Century slipped on the Magazine Hill Fault and Pandoras Fault.

The geological interpretation also indicates at least one fault-bound roof raft above the Century deposit. The relative timing of emplacement of this slab, vis-à-vis the Pandoras Fault is unclear; nevertheless, the upper raft with mega-clasts of Proterozoic within a disturbed Cambrian limestone matrix at least in some locations overlies the Ordovician suevite layer. This is clearly an inverted stratigraphy.

Reconstructions of the deposit allow a series of events to be established, presented in Figs. 12 shows an interpretation of the pre-impact geological setting; the impact; progressive slumping of rafts into the crater, each floored by a detachment fault and retreating at successively lower angles, away from the crater. This shows that, if Century mineralization was present in the 'missing slab', it is likely preserved at a deeper level, between the current deposit and the deep part of the annulus (or crater) northeast of Century.

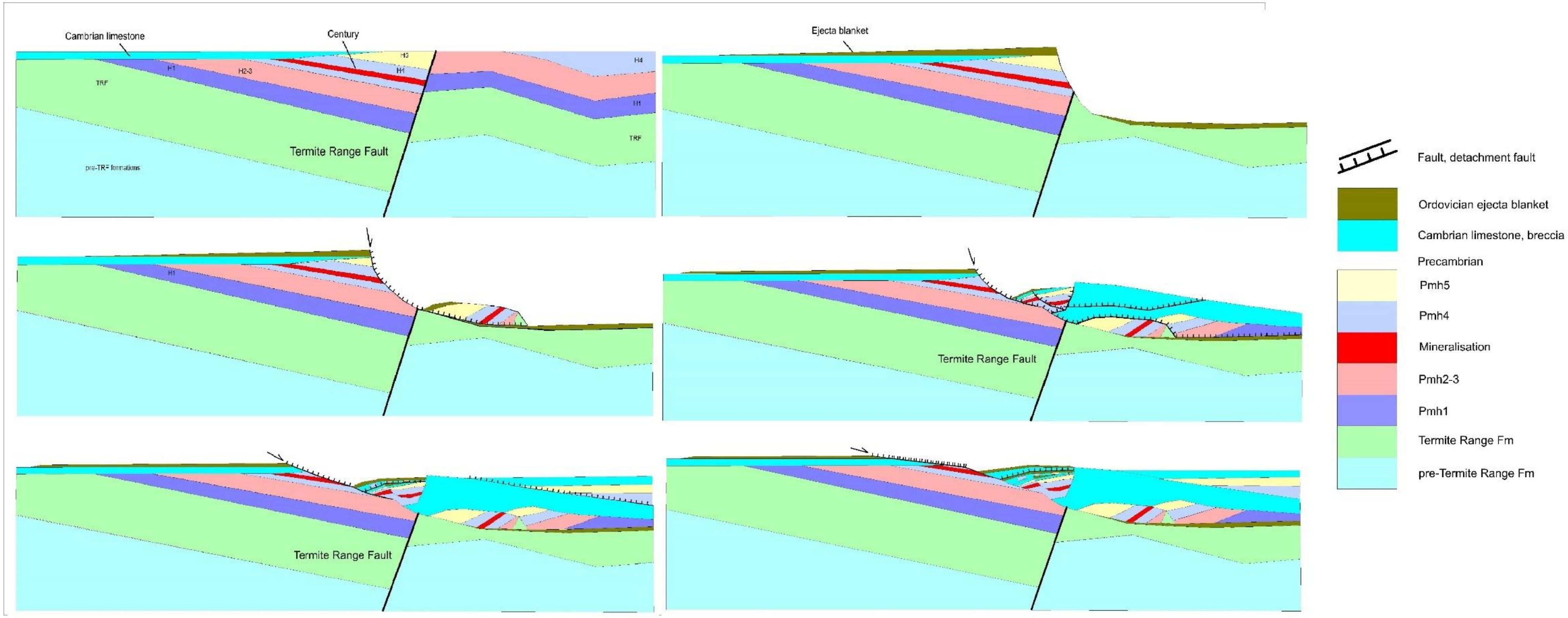


Figure 12. Conjectured cross section reconstructions across the Century deposit looking NW: A: Late Cambrian/early Ordovician, prior to impact. Folded Proterozoic sequence with Cambrian limestone unconformably overlying. B: Immediately after impact, crater c. 10-14km across, 0.5->2.0 km deep; the central dome would be to the NE. C: First slide into the crater; the missing part of Century; a rotated raft an unknown distance from the original deposit. D: Further slides, Magazine Hill Fault and Pandoras Fault, also major slides of other slabs (timing and size unknown), into the crater. The geometry shown is possible and is invoked to explain Nikkis Fault. E: Further slides of the Century deposit, the detachments work progressively away from the crater and are shallower; this raft contains large slabs of footwall, hangingwall and the EFB. There are also more slides into the crater. F: Final “Roof Slab” emplaced over previous slabs. Some mineralisation may have remained in original position in the Page Creek Syncline.

7.2 2018 IP Geophysical Survey & 3D crater modelling

Modelling of the crater profile was completed using interpretations of 2D sections from the 2018 IP Geophysical survey. The base of Cambrian was defined using the contrasting resitivity and chargeability properties between the Cambrian Limestones and Dolomites and the underlying Proterozoic shales, siltstones and sandstones.

From this a 3D and a pseudo depth model was generated. Where possible modelling was constrained and validated by local drill hole data. The method has an estimated accuracy for depth of approximately +/-10% and produced a clear crater geometry for modelling and drill targetting.

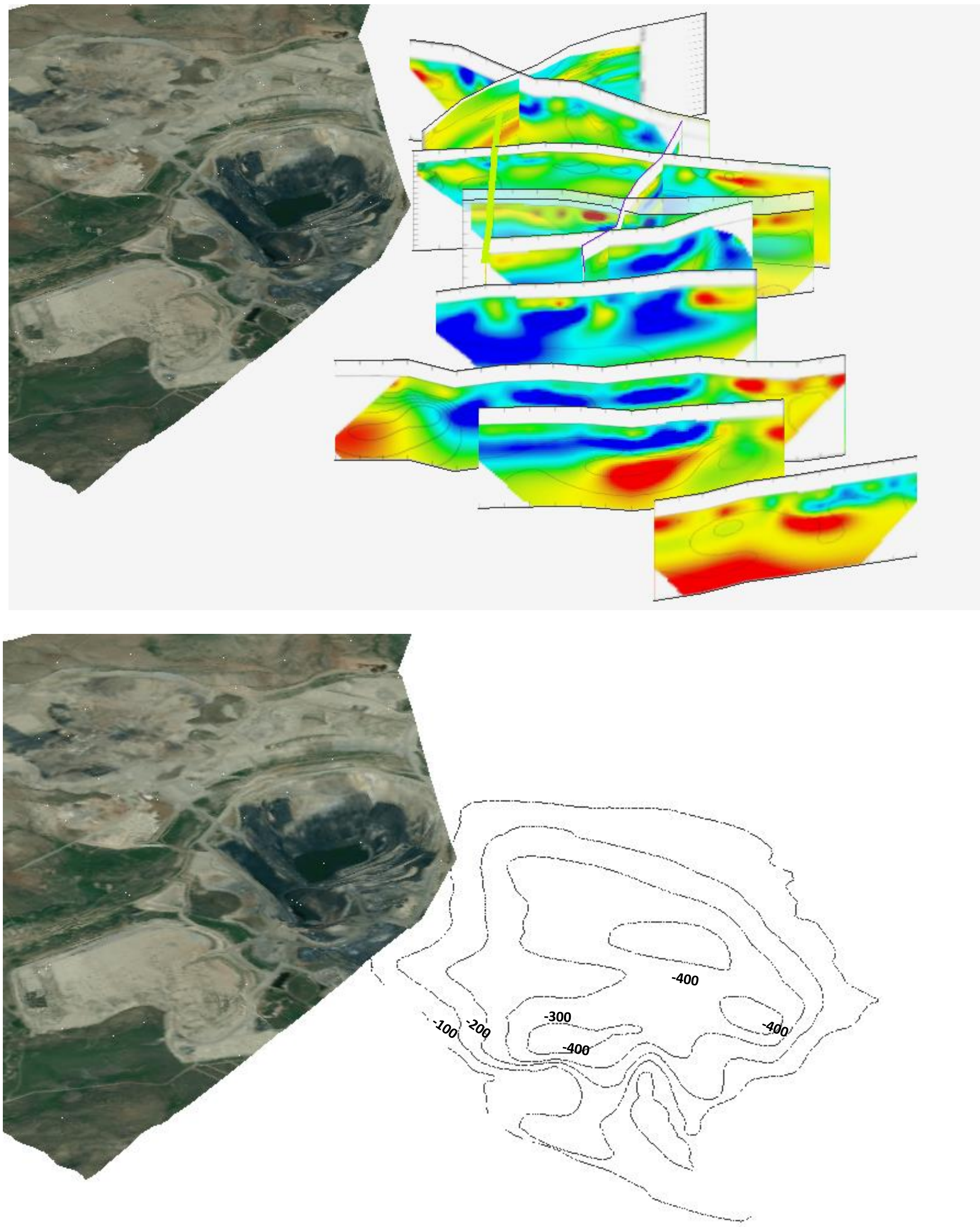


Figure 13. IP Resistivity model sections and crater pseudo-depth contours interpreted from sections.

7.3 Orebody Reconstruction

Using the grade estimates within the Mineral Resource model used during mine operations, zinc grade contours were generated. The contours clearly show natural diminution of grades both laterally and vertically from a central locus, with sharp terminations as a result of unconformable or disconformable contacts.

Extensional structures across the orebody were reversed and grade contours were manually extrapolated and closed to infer the original extents of the mineralised body.

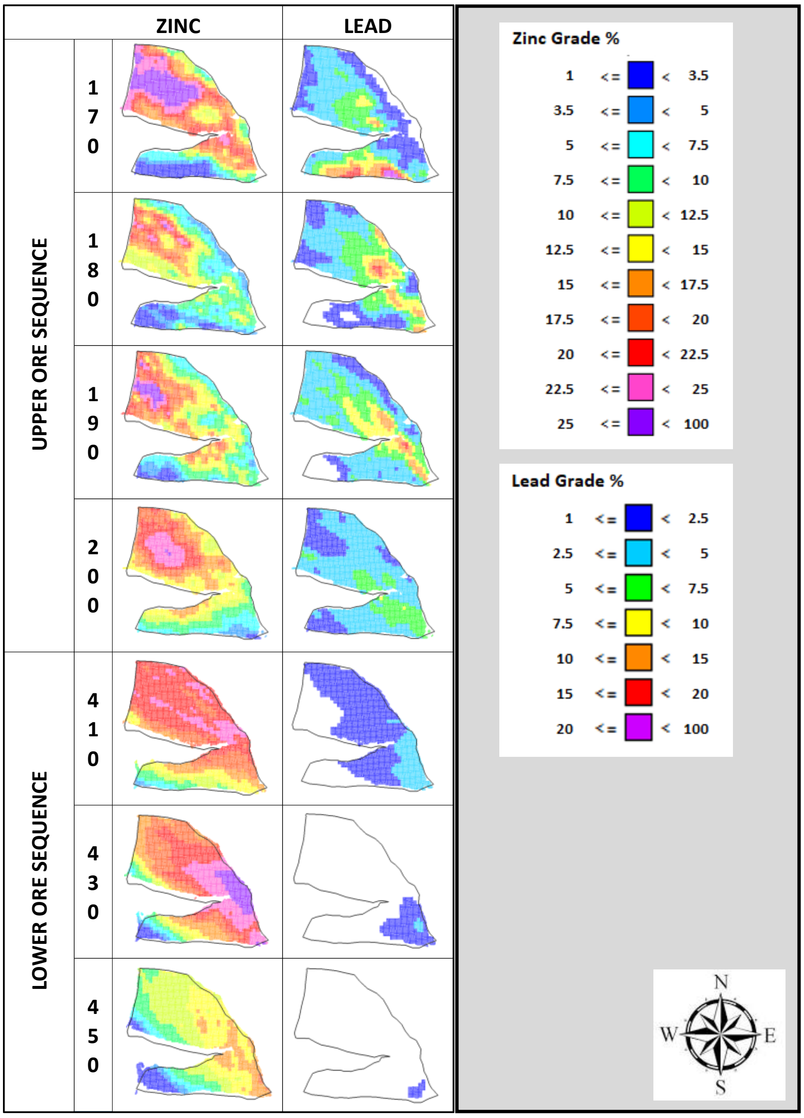


Figure 14. Metal distribution plots for zinc and lead showing lateral and vertical migration of mineralisation.

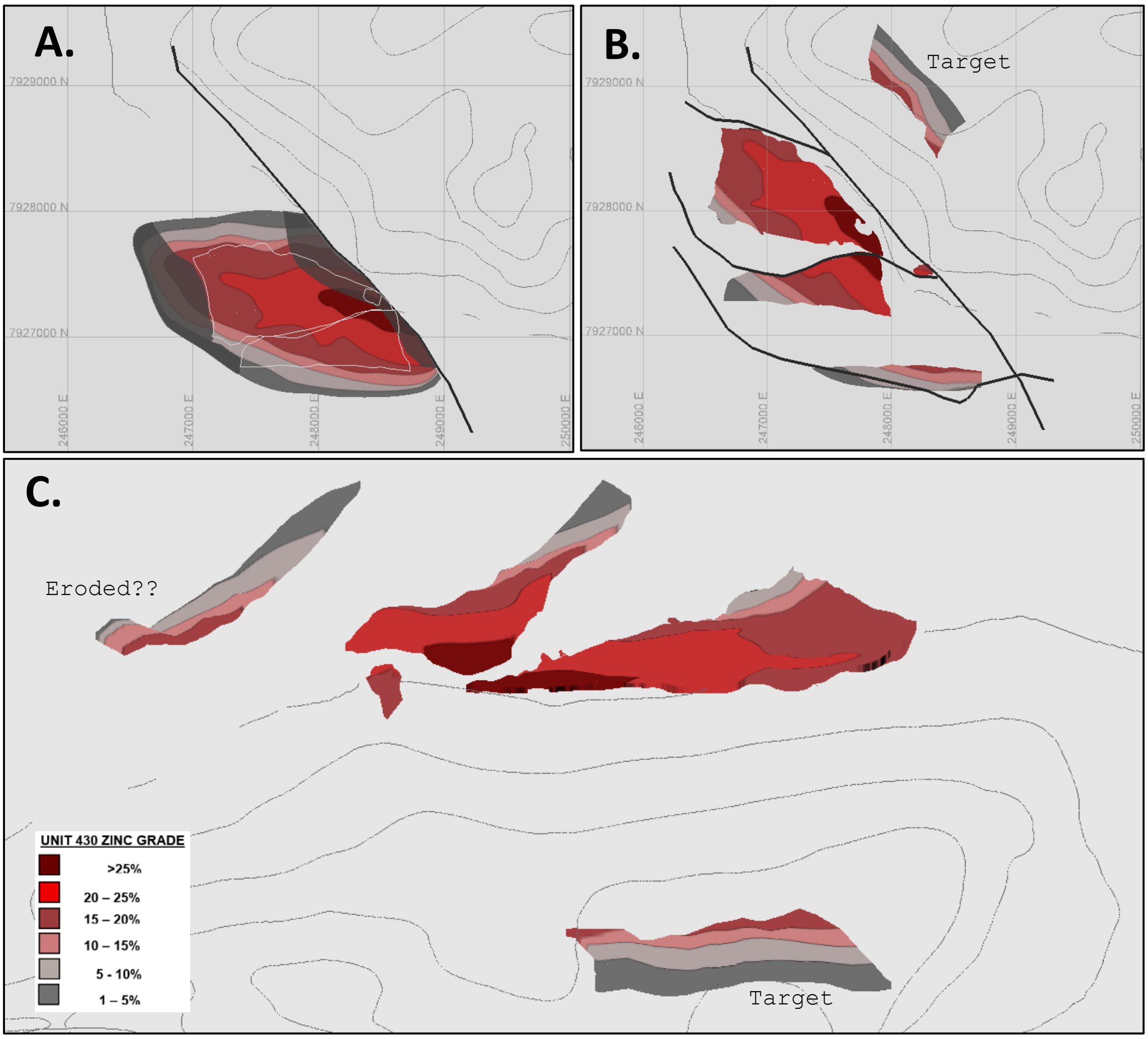


Figure 15. Orebody reconstruction using Zinc grade contours of Century Ore Unit430, with conjectured Post-impact gravitational collapse into crater.

The estimated size of the mineralised body at formation is >200Mt @ 10% zinc (approximately twice the size of the orebody at discovery). This estimate is based upon the reconstructed surface area relative to the orebody at discovery and makes no account for variable bedding thicknesses.

Opportunity lies in understanding the timing, and mechanisms for the unconformities which ring the orebody with particular interest in the pre-impact location and extents of mineralisation.

These learnings define the prospects for potential future discovery.

8. The Millennium Project – Collaborative Exploration Initiative Round 2

The following section outlines the deep drilling activities for which Collaborative Exploration Initiative funding support was approved.

8.1 Objectives

The proposed program of three deep diamond drill holes aimed to:

- Define the base of the crater which would define the maximum target depth for future exploration.
- Assist in defining the architecture of slump blocks and detached rafts within crater;
- Test for potential Century-style mineralisation within a slumped block, or detached raft;
- Test a large IP anomaly defined in the 2018 survey.

All three holes would drill through the crater fill and transported rafts into the base of the crater. The crater base should be defined by a suevitic ejecta layer then highly deformed Proterozoic with shock and melt features. This will be a significant step forward in establishing the crater architecture.

The exploratory holes were designed using slumping vectors interpreted from both orebody displacement, and the underlying crater geometry inferred from the 2018 IP Geophysical Survey. The assumption is that any potential detached blocks or rafts would most likely migrate toward the central topographic low of the crater with gravitational collapse and in-flow.

In addition, an anomalous high was targeted by NCR015 for a potentially rotated slump block.

The holes aimed to better define the crater by identifying unique impact related features such as – suevite, flow deposits, breccias, slump blocks, mega-clast rafts, and injection dykes/sills; with the ultimate goal of discovering economically recoverable mineralisation displaced from the Century Orebody.

8.2 Hole Locations:

HOLE ID	EAST	NORTH	Collar RL	Azimuth	Inclination	Hole depth
NCR014	248075	7929112	205	0	-90	675
NCR015	248439	7927753	155	156	-75	326
NCR016	248550	7929516	209	0	-90	598

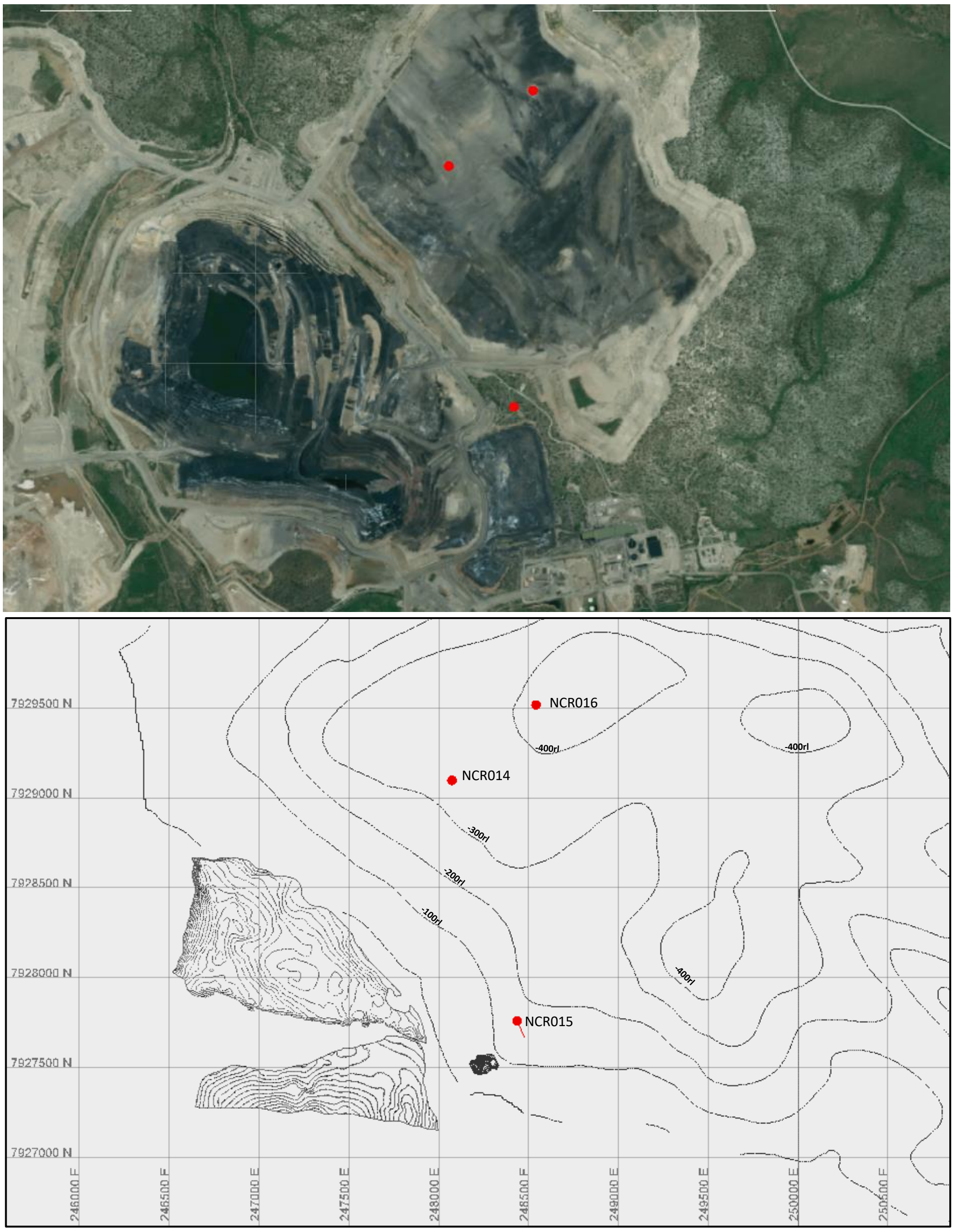


Figure 16. Drill hole locations – Above: aerial photograph showing open pit and northern waste dump; Below: modelled crater depth from 2018 IP survey with Century orebody contours.

8.3 Survey Data

Down-hole surveys were carried out using a north seeking Axis Champ Gyro-compass at regular intervals to ensure no material deviation from the planned vertical inclination occurred.

Detailed orientation data of core was not collected as it was considered unreliable as a diagnostic tool within the chaotic crater fill.

All hole collar locations were located by a registered surveyor using Differential GPS to within +/- 1m accuracy.

8.4 Sampling & Analysis

No samples have been identified for geochemical analysis at the time of reporting.

8.5 Drilling Summary & Logs

Summary drill logs of the three holes are included below.

NCR014

Target: Deep zone following modelled slumping vectors

Commenced: 12/05/2019 *Completed: 27/05/2019*

From (m)	To (m)	Stratigraphy	Lithology	Colour	Description
0	35		Dump rock		Rubble; collared through waste dump; no recovery
35	422.4	Cmt	Cambrian Limestone/Dolomite	Cream	Cmt dolomite, massive, occasional siliceous nodules; occ stylolites.
422.4	504.2	Cmt	Breccia	Grey	**Carbonate matrix polymict (CBX)**
504.2	508.4	Cmt	Dolomite	Grey	Silty dolomite, minor shale, patches of yellow sphalerite blebs and locally disseminated fine grained sphalerite in laminated beds near base.
508.4	551.7	Cmt	Breccia	White	**Carbonate matrix polymict CBX**
551.7	586.05	Cmt	Cambrian Limestone/Dolomite	Mottled	Massive, vuggy, fractured dolomite, stylolites. Small clay pug (fault?) 579.2-579.3m.
586.05	586.8	Structure	Breccia	Grey	Carbonate matrix polymict **CBX**; likely fault at the contact between Cambrian and Prot raft; core loss 586.6-586.8.
586.8	603.6	H4r	Siltstone/Shale interbedded	Grey	Thin bedded, laminated, siltstone and shale, moderate siderite alteration, stylolitic, seams of fine grained sph and py. Fault/shear 596.2-596.2; Carbonate matrix polymict breccia. **Carbonate Breccia CBX intervals also:** 594.35-594.65; 599.6-599.9.
603.6	605.9	Structure	Breccia		Carbonate matrix polymict **CBX, with black shale clasts, faulted at 603.6. Fault and/or dyke within the Prot raft.**
605.9	609.6	H4r	Siltstone/Shale interbedded	Grey	Laminated grey siltstone and massive, black carbonaceous shale, strongly sheared, gouge zones; with carbonate+pyrite veins subparallel and orthogonal to bedding; fault contact at 609.6 Carbonate matrix polymict. **Carbonate Breccia CBX intervals:** 607.75-607.85 608.25-608.3m.
609.6	611.5	Cmt	Cambrian Limestone/Dolomite	Grey	Dolomite, massive, fine grained, recrystallised; sits above suevite

From (m)	To (m)	Stratigraphy	Lithology	Colour	Description
611.5	611.8				**Suevite:** CLSB breccia, polymict, silica grains (spherulites?), ashy (welded?) matrix; 611.5-611.8 crowded quartz and various clasts incl hm, qtz-py. ***Interpreted as base of Lawn Hill Impact Structure*.**
611.8	613.35		Shale	Grey	Bleached, partially disrupted shale (Prot: H1?).
613.35	613.65	Structure	Breccia		Carbonate matrix polymict **CBX**. Some siliceous frags (melt?), and void filled vughs, locally sulphidic.
613.65	627	H1	Shale	Black	Black carbonaceous shale (BCS), loc thin bedded/laminated, bedding 30-70 degrees, moderately sheared in which case often graphitic.
627	632.4	H1	Shale	Black	Black strongly sheared BCS, graphitic; represents sheared base of BCS (Pmh1) on Pmt.
632.4	633.4	Structure	Breccia		Carbonate matrix polymict **CBX**.
633.4	638.4	T2	Shale/Sandstone interbedded		Strongly sheared shale and sandstone, graphitic
633.4	639.4	Structure	Fault zone		Fault zone within black shales, also pug/clay, sheared and brecciated. **Carbonate Breccia CBX interval:** 631.4-632.5.
639.4	675.2 EOH	T2	Shale/Sandstone interbedded		Pmt, interbedded SANDSTONE, SLT, SHALE as follows: 639.2-641.2 Black carbonaceous shale, thin siltstone streaks; 641.2-641.7 grey, siltstone, fine sandstone, massive bed of siltstone to fine SANDSTONE; 641.7-643.6 black carbonaceous shale; 643.6-646.0 interbedded black shale, silt, fine grey Sandstone graded bed, lode cast base, bedding 10 degrees; 646.0-649.1 massive grey sandstone bed; 649.1-675.2 Black shale, silt, fine grey Sandstone graded beds, 1m shale to 1m to 1.5m Sandstone couplets, common shale flake breccia towards tops of beds. **Carbonate matrix polymict CBX** 650.75-650.8 650.95-651.0m.

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Summary Log: NCR015

Target: shallow ridge in IP model adjacent to Eastern Fault Block deposit

Commenced: 08/05/2049 *Completed:12/05/2019*

From (m)	To (m)	Stratigraphy	Lithology	Colour	Description
0.0	2.0	Q	Dolomite		Rubble
2.0	20.0	Cmt	Dolomite	Cream	Cambrian dolomite weathered, Fe stg - some weathering
20.0	21.0	Cmt	Fault breccia	Cream	Clay, FT zone
21.0	204.2	Cmt	Dolomite	Cream	Cambrian dolomite massive, cream. **Carbonate Breccia CBX intervals:** (angular fragments in RC chips) 94-102m 171-179m 200-204.2m.
204.2	223.3	Cmt	Dolomite	Cream	Cambrian massive dolomite and monomict dolomite breccia; when massive has sil nodules. CLS 221.3-221.8m.
223.3	229.4	Cmt	Dolomite	Cream	Cambrian dolomite, fractured, broken, several core loss intervals
229.4	254.5	Cmt	Dolomite	Cream	Cambrian dolomite massive, bedded dolomite, consistent core angles, c. 30 LCA. Broken sections 233.5-234.5, 237.5-240.0, 246.6-248.4.
254.5	255.3	Cmt	Breccia	Cream - grey	Cambrian massive **CBX**, angular frags (not fault), polymict, massive.
255.3	271.7	Cmt	Dolomite	Cream	Cambrian massive dolomite and monomict dolomite breccia, minor vughs. 268.9-269.9m. very broken.
271.7	274.15	Cmt	Dolomite	Grey	Dolomite, weakly sheared, de-textured. Initially bleached 271.7-272.6m, with sil nodules. At 274.15m, sharp, planar contact.

From (m)	To (m)	Stratigraphy	Lithology	Colour	Description
274.15	274.9		Sandstone	Brown/ Red	**Suevite.** 274.15-274.4 red-brown grit, various small rock frags 1-5mm, hm, shale, py, quartz grains; hematitic. 274.4-274.6, jigsaw breccia of angular shale shingles in hm matrix. 274.6-274.9 clay with frags SHALE; could be fault(?) but no fabric.
274.9	295	LFW (H4r)	Siltstone	Grey/ Red	Interbedded siltstone and subordinate dark grey shale; patchy hm alteration overprint along fracs. Bands BCS increase from 290.5m. Small puggy faults at 281.2m, 281.5-281.6m, at 284.8m, 287.1m, 289.1m. Fault with epithermal quartz 289.6-289.7, 293.5-294.1m.
295	326.3	H4r	Shale	Black	Black, massive to sometimes poorly bedded, BCS. Minor thin shears and graphitic shear planes, minor quartz veinlets; minor 1-3cm py bands/nodules at 298.4 and 298.7 (fold); 304.3, 304.5, 307.75, 311.7, 317.9m; minor thin bands carb (cal/dol) spotting.

NCR016

Target: Deep zone following modelled slumping vectors – toward central crater from NCR014

Commenced: 12/05/2019 *Completed: 27/05/2019*

From	To	Stratigraphy	Lithology	Colour	Description Summary
0.0	42.0		Dump rock		Waste dump
42.0	198.0	Cmt	Dolomite	Grey-cream-brown	RC collar - dolomite, siliceous nodules and fragments. **Carbonate Breccia CBX intervals:** 118-120m (?) 137-139m.

From	To	Stratigraphy	Lithology	Colour	Description Summary
198.0	403.1	Cmt	Dolomite	Cream-grey	Dolomite, massive recrystallised, sugary, porous, with common small and occasional larger calcite-lined vughs, relict bedding (usually high LCA so flat-lying unit), stylolites, possible stromatolites. **Carbonate Breccia CBX intervals:** 227.9-228m, 342.7-343.15m. Massive to brecciated (monomict) dolomite at base of interval.
403.1	445.0	Cmt	Dolomite	Cream-grey	Change to silty bedded dolomite, less dolomitised, local siliceous nodules, Bedding high angle to core. At 403.1 sharp contact. 412.8-414.5 massive cream dolomite. Polymict breccia zones (appear not to be faults) Same as CBX(?) 420.3-420.4, 420.9-421.2, 426.0-429.6, 431.0-431.3. 415.5-416.0 possible brachiopod shells. 433.0-438.1 darker grey silty dolomite, nodules, possible brachiopod shells, stylolites; sharp contact at 438.1. 428.1-439.3 massive cream dolomite. **Carbonate Breccia CBX interval:** 439.05-439.15.
445.0	480.6	Cmt	Dolomite	Cream-grey	Mottled dolomite, abundant chaotic cream and tan dolomite, and grey siliceous, nodules in f.g. dolomite matrix, sparse coarse vughs, some discontinuous vuggy calcite veinlets. **475.0-477.6** cream intensely dolomitized, sugary, several stylolites including contacts.

From	To	Stratigraphy	Lithology	Colour	Description Summary
					Carbonate Breccia CBX intervals: 467.5-467.8 480.45-480.6 breccia at base Cmt. This is base of slumped Cambrian on impact-affected H2/3.
480.6	482.0	H2/3	Brecciated siltstone/shale and sandstone		Siltstone with biscuit breccia intervals, indicates impact-affected.
482.0	493.0	H2/3	Siltstone/shale and sandstone	Green-grey	Siltstone, shale and fine sandstone, loc pyrite veins with selvages (Photo x1). Sandstone v hematitic. 2.4m drop core
493.0	525.8	H2/3	Siltstone/shale and sandstone	Mottled-red	Proterozoic Basement Siltstone, shale, sandstone - hematite alteration concentrated in shales/siltstones and generally bedding parallel.
525.8	582.7	H2/3	Shale/siltstones	Black-grey	Black/grey shale/siltstones/sandstone - fresh, occasional tuff bands cm scale - Unit H2/3.
582.7	597.6	H1	Shale	Black-grey	Black carbonaceous shale dominant unit - Unit H1

8.6 **Petrography**

Several samples were sent for petrography, mainly units associated with the suevite position, for confirmation of its' origin. A report is not anticipated until late August.

Figure 17. Photograph of the suevite in NCR015; 274.15-274.9m. Above is recrystallised dolomite, interpreted as the base of a slump sheet, and below is bleached and hematite altered (weathered?) Pmh4r (or perhaps Pmh1) in the crater floor.

8.7 **Outcomes and Geological Interpretation**

8.7.1 Outcomes

Three drill holes, NCR014 (675.2m), NCR015 (326.3m) and NCR016 (597.6m) were drilled to:

- test the concept that large rafts of Century host rocks slumped into the LHIS soon after impact, and that such rafts potentially contain mineralisation displaced from the Century deposit;
- define the architecture of the LHIS in the area of perceived prospectivity;
- test a large IP anomaly defined by the 2018 deep IP in the mine area.

NCR014 intersected a sequence of Century host rocks (Pmh4) above the base of the crater, as predicted. The sequence appears to be Pmh4r, below the Century ore position, however, "Proof of Concept" has been established. The presence of Pmh4 here opens up an area of untested potential mainly beneath the north waste rock dump.

NCR015, to the northeast of the East Fault Block, was drilled to define the architecture of the crater in this area, with the possibility of intersecting rafts similar to the East Fault Block, containing mineralisation detached from the Century deposit.

NCR016, some 600m northeast of NCR014, intersected entirely slumped Cambrian carbonates above the suevite which marks the crater floor. This demonstrates it on the slope between the central dome and ring syncline of the crater. This position we now know has limited potential, and the ring syncline is likely to be where rafts of Pmh4 are located. The broad, deep IP anomaly defined in the 2018 survey is shown to be a response to Pmh1 shales below the crater floor; thus, there is little potential for economic discovery related to this feature.

8.7.1 Geological Interpretation

The three Collaborative Exploration Initiative drill holes, together with other shallower holes drill recently by New Century, and additional mapping in the mine area, provide valuable insights into the LHIS formation and displacement and fragmentation of the Century deposit.

The hypothesis of the displaced Century deposit is now largely proven (eg. Lees et al., 2019), however with new information, concepts are evolving with new evidence and indications of complex, impact-related features which could be expected in such impact structures, including radial transpression ridges, slump terraces, etc., (Fig. 18; also see Kenkmann et al., 2014).

To aid interpretation of the larger structure of the crater architecture, simplified summaries of the main drill holes are included here, with comments on interpretation of the results.

NCR014

0-35: Dump material.

35-586.05: Cambrian carbonate, slumped crater fill.

586.05-609.6: Black shale; slumped raft of Proterozoic H4r (footwall to Century ore position).

609.6-611.5: Grey, fine likely recrystallized Cambrian dolomite; perhaps basal part of rafted crater-fill (?).

611.5-611.8 Suevite, marks the base of crater with thin impact-derived sediment.

611.8-633.4: Black shale, likely Pmh1.

633.4-675.2: Sandstone, siltstone, shale; likely Termite Range Formation Pmt.

This hole provides evidence of the rafting of the Century host rock sequence (albeit below the ore position) into the crater, close to the base of a thick, slumped sequence of deformed Cambrian carbonates. Suevite below the slumped sequence marks the base of the crater, and below this the disturbed Proterozoic sequence in the crater floor comprises Pmh1 overlying Pmt.

NCR015

0-274.15: Cambrian carbonate, slumped crater fill.

274.15-274.9: Suevite marks base of crater.

274.9-326.2: Black carbonaceous shales, Pmh4r.

This hole intersected the crater base (suevite 274.15-274.9m) shallower than expected, indicating a degree of complexity in the crater architecture. Subsequent detailed analysis of existing drill hole data and IP suggests the possibility of an impact-related transpression ridge; a structural ridge oriented radially to the crater (see Kenkmann et al., 2014 for rationale). A transpression ridge may explain the unusually location of the East Fault Block in its' position relatively quite some distance above the Century deposit, and therefore lead to developing drill targets for detached ore blocks along the transpression ridge.

NCR016

0-42: Dump material.

42-480.6: Cambrian carbonate, slumped crater fill. Base of unit at 480.6 marks base of crater.

480.6-582.7: Lithic sandstone, siltstone, Pmh2-3. Breccias at top (480.6-482.0) suggest impact affected. Hematitic interval c. 493-503m is likely a result of Precambrian weathering.

582.7-597.6: Shale; Pmh1.

This more easterly of the two deep holes was designed to define the crater architecture and test the large, strong IP anomaly generated from the 2018 deep IP survey.

The relatively simple geological interpretation is the hole intersected slumped Cambrian carbonates, to 480.6m, then Pmh2-3 in the crater floor (with impact breccias in the top 2 metres), followed by shales of Pmh1. The carbonaceous black shales of Pmh1 are the likely explanation of the IP anomaly.

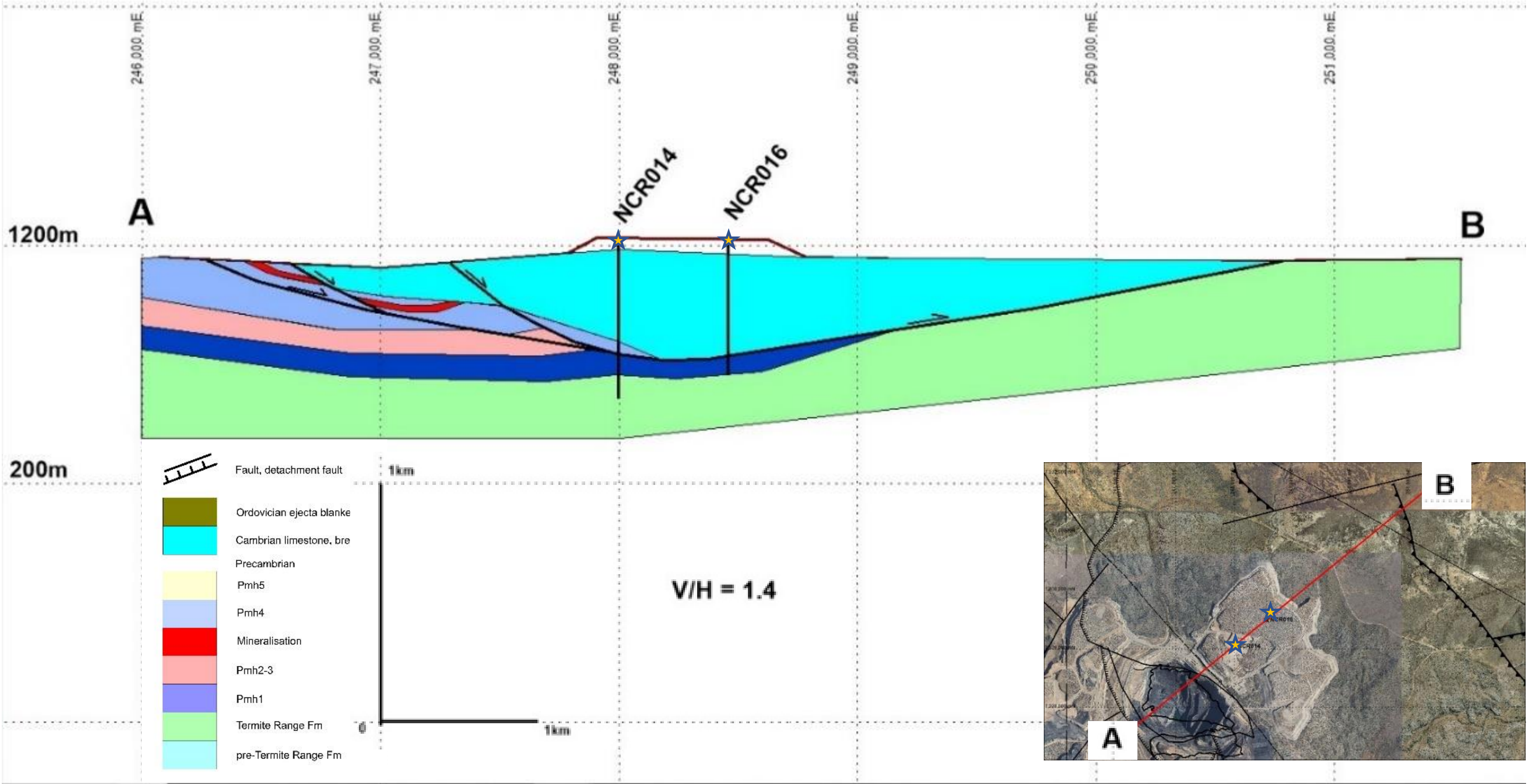

Figure 18. Cross-section oriented NE (looking NW) of interpreted geology. Eastings are projected onto the section.

The interpreted positions of the Century Deposit, and the Millennium Project drill holes within the context of Kenkmann et al 2014 schematic for complex craters:

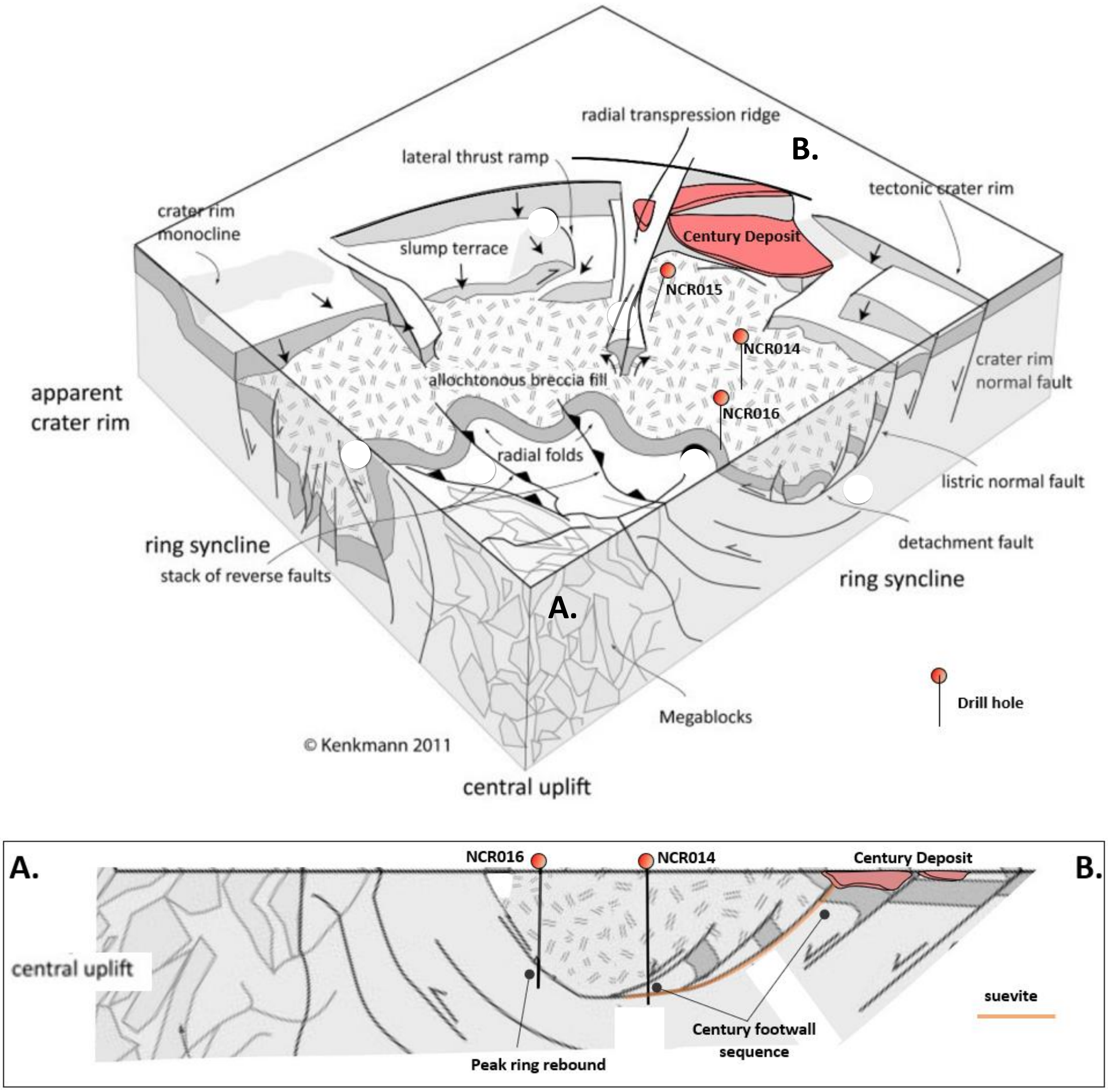

Figure 19. from Kenkmann et al 2014 modified with permission: the interpreted location of the Century deposit(red) within the crater structure; along with interpreted positions of drill holes relative to crater features– schematic section A-B.

9. Summary Comments

Three deep drill holes for a total of 1599.1m, were drilled as described in the CEI proposal. The concept tested is that the LHIS, generated by an Ordovician meteorite, caused displacement of the Century deposit. Rafts of the Century host rocks (Pmh4) were thought to have slumped into the crater, along with thick, now deformed, Cambrian carbonate.

NCR014 (675.2m) was drilled 1.0km NE of the eastern edge of the Century deposit, and across the Termite Range Fault. The hole intersected what is believed to be a large raft of Century host rock footwall sequence above suevite which marks the base of the crater. This opens up an untested area of up to 2 square kilometers where the Century host sequence is likely to be present.

NCR015 (326.3m) was drilled NE of the East Fault Block. The hole encountered suevite defining the base of crater and transitioned into the underlying Lower footwall (LFW) sequence to the Century host sequence. This hole confirmed the presence of an anomalous shallow zone apparent in the IP pseudo-depth model and contributed to the interpretation of this zone as a radial transpression ridge. This interpretation provides an explanation for the position of the Eastern Fault block relative to the main orebody, and additionally gives a clear basis for a previously poorly explained - clay, block, and breccia zone which runs along, and parallel to, the modelled ridge. With further work this zone may present a target for future exploration for small shallow blocks of mineralization analogous to the Eastern Fault block.

NCR016 (597.6m) was drilled a further 600m NE of NCR014. No Century host rocks were intersected, with Cambrian carbonates above the crater floor, with Pmh2-3 then Pmh1 below the crater floor. Suevite appears to be absent, but impact-related breccias are likely present at the crater floor in Pmh2-3. In terms of crater architecture, this position is interpreted to be on the slope between the central domal uplift and the ring syncline. This effectively limits the zone where Century host rocks may occur within the crater fill.

The information and knowledge gained from this drilling significantly advanced our understanding of the crater architecture and more closely defined a target for Century mineralisation with rafts of Pmh4 within the crater. New ideas, such as the transpression ridge apparently associated with the East Fault Block, also emerged and may lead to more drilling, and perhaps, discovery.

10. Recommendations and future work

The information gained from this drilling program has resulted in vastly improved knowledge of the crater architecture and more closely defined the area of potential for slumped rafts of Century host rocks (Pmh4) in the crater.

Further work within New Century will focus on the following:

- Build a detailed 3D model through reinterpretation of detailed historic mine cross-sections;
- Drill test further targets related to the slumped raft/s of Pmh4 within the crater;
- Develop crater architecture models and specific drill targets along the transpression ridge and in the vicinity of the East Fault Block.

11. Acknowledgements

The geology of the Century mine is best recorded in serial cross-sections generated by S. King of Solid Geology (consultant for various companies at Century); however, there is no specific reference for the significant volume of work: serial sections N-S and E-W of the Century deposit, at 50m spacings. This work has been an important contribution allowing reinterpretation of the post-mineralisation events.

Associate Professor Andy Tomkins, from Monash University, has been of valuable assistance with the petrography of suevite samples, and in meteorite impact geology.

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Appendix A: Petrography

Petrography (courtesy of Assoc Prof Andy Tomkins at Monash University), shows evidence of melt and planar deformation fabrics, both strong evidence of a suevite.

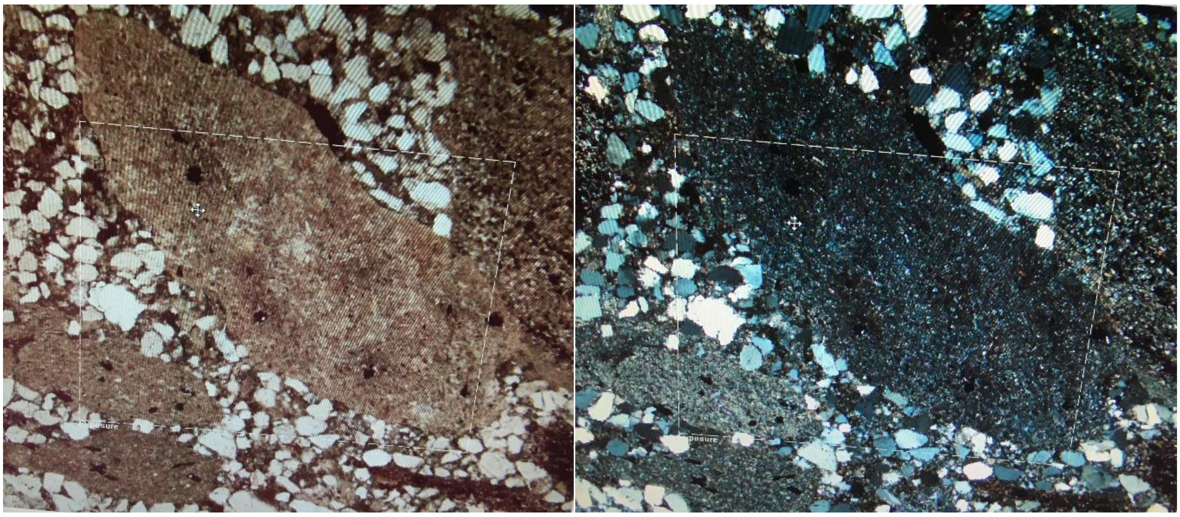

Fig. 1: Amoeboid-shaped clast about 0.5cm long, which wraps around the end of a harder clast; plane polarized light (left), crossed polars (right).

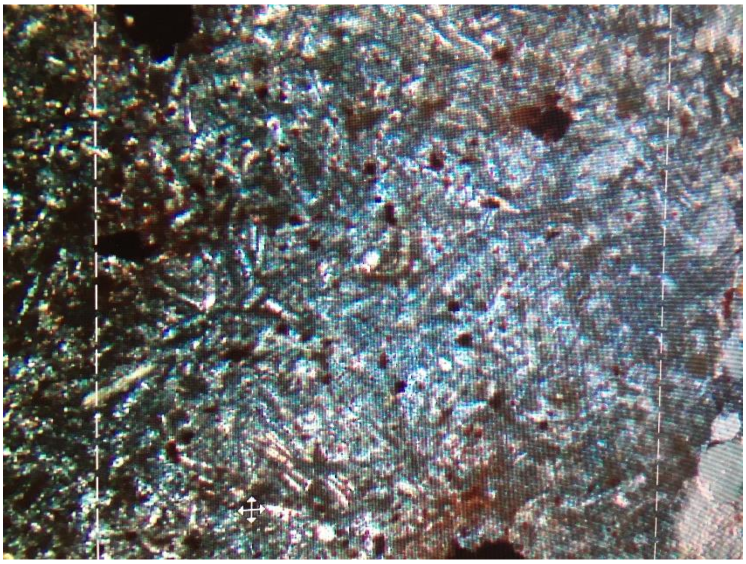

Fig. 2. Close up of the crystal textures, likely devitrified glass.