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Jangheung Cu-Zn-Ag-Pb project

Technical Summary

The Jangheung Cu-Zn-Ag-Pb project lies in the southwestern coastal region of South Korea, about 7km southeast of the town of Jangheung, within Boseong-gun county of Chollanam-Do Province.

Historical exploration by the *Korean Institute of Energy Resources* ("KIER") during the 1970s located a 'cluster' of 16 polymetallic Cu-Zn-Ag-Pb mineralized breccia pipes at Jangheung. Exploration conducted by KIER (1982) included soil geochemical surveys, VLF and IP geophysical surveys and limited diamond drilling (12 holes for 1,524m). Most of the drilling was focussed on only three of the breccia pipes (Anomalies I, E & B), recording significant mineralized intersections:

Intersection	CuEq (%)	Hole ID	Interval	Anomaly ID	Cu (%)	Pb (%)	Zn (%)	Note		
146m	2.45	JD-10	0 - 146m	Anomaly B	0.44	0.26	4.87			
69m	1.71	JD-11	33 - 102m	Anomaly B	0.21	0.09	3.73	CuEq was calculated using		
34m	1.71	JD-12	71 - 105m	Anomaly B	0.28	0.19	3.47	April 2016 metal prices of:		
8m	5.32	JD-7	16 - 24m	Anomaly E	1.27	6.03	4.80	Cu = US\$2.18/lb Pb = US\$0.78/lb		
9m	2.42	JD-7	53 - 62m	Anomaly E	1.10	1.27	2.20	Zn = US\$0.86/lb.		
6m	4.10	JD-1	23 - 29m	Anomaly I	0.16	2.85	7.40			

Based on the drill results, KIER (1982) reported a historical inferred mineral resource¹ of 1Mt @ combined 5% Cu-Pb-Zn & 64g/t Ag, at Anomalies E and B. There has been no modern exploration conducted on the Jangheung project since 1982.

Mineralization at Jangheung consists of high-grade Cu-Zn-Ag-Pb mineralized breccia pipes with a subvertical inverted cone or 'carrot-shaped' morphology, associated with the intrusion of Cretaceous diorite porphyry into basement granite gneiss. Although silver was not analysed in drill core, a bulk metallurgical sample (Anomaly E) collected by KIER indicated significant silver (>100g/t Ag) accompanies the base metal mineralization (confirmed by KME rock chip sampling). In places, the diorite porphyry is intensely carbonate altered and contains stockwork and disseminated lower-grade Cu-Zn-Ag-Pb sulphide mineralization. Some thermal oxidation/supergene leaching/telescoping overprinting effects may have occurred in the upper levels of the breccia pipes.

The polymetallic Cu-Zn-Ag-Pb (± As-Bi-Mo-Ba-Fe-Mn) mineralization at Jangheung is classified as magmatic-hydrothermal intrusion-related breccia pipes, associated with the degassing and de-volatilization of a mineralized diorite porphyry, depositing at relatively deep crustal levels 4-8km.

The breccia pipes occur as a 'cluster' of 16 outcrops distributed within a relatively small area of 1500m x 1000m. Anomalous soil geochemistry and geophysical responses suggest some of the pipes are connected at depth. Most of the breccia pipes mapped by KIER remain unexplored. KME considers it highly likely more 'blind' pipes can be expected at depth within the Jangheung project area.

A close-spaced (50m line spacing) UAV drone VLF/EM geophysical survey is considered to be the best geophysical exploration tool to locate 'blind' mineralized breccia pipes in the area. Check diamond drilling of the breccias at Anomalies B, E, F and I is recommended to confirm grades, followed by resource definition drilling. Drill core should be collected for detailed geotechnical and metallurgical investigations.

Korean Metals Exploration Pty Ltd ("KME") believes there is excellent potential for a modest-sized mining operation, sourcing high-grade polymetallic ores from multiple pipes to feed a central milling facility. The subvertical geometry of the breccia pipes is amenable to extraction by the novel *Sustainable Mining by Drilling* method using locally-manufactured mobile crawler track-mounted Pile Top RC Drills.

¹ Cautionary Statement: This resource was classified based upon the *Korean Institute of Energy Resources* resource estimation classification scheme and reporting nomenclature (1982). The resource estimate is historical and does not comply with current NI43-101 or 2012 JORC Code reporting requirements.

Local Infrastructure

Jangheung town is a 4½ hour drive from Seoul using the *Gyeonggbu, Nonsan-Cheonan* and *Jeonju-Sunchen* and the *Yongam Expressway* to Jangheung. The prospect area is easily accessible by sealed road from Jangheung.

Jangheung (population 53,392) is a rural town, featuring good infrastructure, including engineering and machinery repair facilities and hardware shops to support the agriculture-dominated local economy, as well as motel accommodation and restaurants.

Land-use is dominated by paddy rice and feedlot cattle farming at the small farming villages of Eunheung-ri and Haksong-ri. The villages are served by a good network of local powerlines and paved roads. The cellular phone system provides good Wi-Fi, 5G mobile communications coverage for the area.

Most of the small creeks draining the prospect area (radial pattern) have small rock-wall dams installed to capture June-August "wet season" rainfall runoff and are used mainly as a water supply for local farms.

Geology

The Jangheung Cu-Pb-Zn-Ag project is situated within the Suncheon Metallogenic Province (Choi et al, 2006). Basement rocks are composed of gneiss, granite gneiss and schist of the Precambrian Sobaegsan Massif (Lee, 1987).



Granitic gneiss occurs as a NNE orientated block at Jangheung. The granite gneiss displays strong porphyroblastic textures, formed by rounded quartz, plagioclase and k-feldspar grains. A crude foliation, formed by aligned biotite micas and the porphyroblasts, displays a consistent NE strike, with moderate dips to the NW. Recent studies by Song et al (2015) obtained a much younger 250Ma age (Early Triassic) for the granite gneiss, but this could be due to recrystallization of basement during the *Songrim Orogeny* **M3** regional metamorphic event, coinciding with compression and continental collision between Eurasia and the Circum-Pacific Plate (Egawa & Lee, 2009).

During the late Jurassic to early Cretaceous, southern Korea was a continental margin of Andean type before the opening of the Sea of Japan. During the Cretaceous, extensional tectonism of this magmatic arc resulted in the emplacement of the *Bulgugsa Granite Series* intrusions as stocks, plugs and dykes along orthogonal transfer fault structures. At Sajasan, diorite porphyry is mapped intruding the granite gneiss basement along an older NW structure, being localised at its intersection with a major NE transfer fault structure.





Small dykes of diorite and andesite porphyry are present near some of the breccia outcrops. Diorite porphyry was intersected in the KIER drilling and is clearly associated with the breccia pipes.

The diorite is composed mainly of oligoclase, hornblende, biotite and quartz, accompanied by minor calcite and magnetite.

The diorite porphyry is interpreted as an evolved, fractionated I-type intrusion that was emplaced in a compressional regime at the continental margin (Soo et al, 2005).

Late Cretaceous age andesite tuff, pyroclastics and volcanic breccia outcrop on the higher elevations, resting as a cap over basement gneiss and diorite porphyry. Xenoliths of sediments are incorporated within the tuff, within a densely packed, poorly sorted mass of inequigranular grains of feldspar, quartz and mafics. The andesite tuff probably represents the "surge" eruptive product phase associated with the *Bulgugsa Series* igneous activity (equivalent to *Yuchon Group*).



Geological Map of the Jangheung Cu-Ag-Zn-Pb Project (1:50,000 scale). The mapped breccia pipes are highlighted in green and Anomalies A-P are labelled. Linear and circular structures interpreted from satellite imagery are shown. The broad magnetic low feature (yellow dashed line) could possibly indicate a magnetite-destructive alteration zone within the Pre-Cambrian basement gneiss, granite gneiss and schist. A diorite porphyry intrusion (red) is mapped in the core of this magnetic low feature.

Mineralization

A "cluster" of 16 polymetallic breccia pipes were discovered in the late 1970s by the KIER (1982) by follow-up prospecting of regional stream sediment geochemical anomalies. The breccia pipes occur as small outcrops, scree and talus, distributed sporadically over an area of 2000m x 740m, that is roughly orientated NNW in a crude sense.

The breccia pipes are composed of variably-sized, sub-rounded, sub angular to angular clasts and fragments of diorite porphyry and basement gneiss and schist (Spadafora, 1994). Most of the breccia clasts are porous, angular and apparently corroded. The angularity of most clasts and fragments, suggests fluidized "streaming" movement, fragment attrition or abrasion did not occur. Sillitoe and Sawkins (1971) suggest that clast-fragment corrosion occurs mainly in the upper portions of these pipes. The more abundant open-space voids and corrosion observed in the upper levels of the pipes are interpreted to be the result of gaseous volatiles preferentially concentrating towards the top of the breccia pipe column.

Some of the larger porphyry clasts are more rounded and display a zoned alteration pattern. A primary igneous texture is still discernible in the inner core, which is surrounded by an inner halo of epidote-chlorite-quartz alteration (inner propylitic assemblage). This zone then grades into a halo of chlorite-epidote-sericite alteration (propylitic) and then into an outer rim or rind of sericite-quartz-sulphide (phyllic assemblage). The presence of rounded clasts is attributed by Sillitoe and Sawkins (1971) to spalling off of the softer, hydrothermally altered rims during collapse of the breccia pipe column, rather than resulting from any abrasive milling effects produced by "streaming" or rapid/prolonged movement.

The matrix of the breccia is composed of a vughy, porous cement of quartz, chlorite, clay, specular hematite and secondary minerals that have replaced primary sulphides (Spadafora, 1994). There is a noticeable lack of rock flour in the matrix, which together with the angularity of most clasts-fragments, suggests fluidized "streaming" movement, fragment attrition or abrasion has played a relatively minor role.





Primary sulphides are rarely observed in surface outcrops and have been replaced by secondary minerals in the supergene, oxidized weathering zone. The primary sulphide minerals identified by KIER (1982) in drill core consist of pyrite, sphalerite, galena, chalcopyrite and arsenopyrite.

Goethite-limonite-hematite-jarosite gossan is common in the breccias and fracture stockworks, and is accompanied by a diverse mix of supergene secondary minerals, including adamite (zinc-arsenic hydroxde), cerussite (lead carbonate), anglesite (lead sulphate), smithsonite (zinc carbonate), black "sooty chalcocite" (copper sulphide), covellite (copper sulphide), chrysocolla (hydrated copper silicate), azurite (copper carbonate), malachite (hydrated copper carbonate), cuprite (copper oxide) and native copper (KIER, 1982). The abundance of secondary minerals suggests supergene weathering, thermal oxidation, hypogene leaching, or other telescoping "overprinting" effects occurred during the late stages of the brecciation and hydrothermal mineralization process.



Prismatic quartz and uralite crystals infilling vugh in breccia at Anomaly I.

The cavities/vughs between the breccia clasts are often lined with cockscomb and comb quartz crystals, exhibiting well-formed prismatic grains, suggesting a relatively gaseous-rich, fluidized hydrothermal breccia mineralizing event took place.

Mineralization

Alteration observed around the breccia-hosted base metal ore mineralization consists of:

- 1. Epidote, chlorite and guartz (inner propylitic assemblage).
- 2. Chlorite, epidote and sericite (propylitic assemblage).
- 3. Main ore stage mineralization with sericite-quartz-carbonate (intermediate argillic-phyllic assemblage).
- 4. Above the pipe, illite clay with lesser sericite and kaolinite clay (argillic assemblage).
- 5. Late supergene alteration composed of secondary minerals, limonitic gossan, hematite and jarosite (ex sulphides).



Breccia dominated by gossanous granite gneiss clasts within a matrix of fine silica-chlorite cement. Anomaly B.



Gossanous quartz vein-fracture stockwork in leached, porous, brecciated diorite porphyry. Anomaly I,



Leached, porous, brecciated mineralized diorite porphyry, with gossanous matrix. Anomaly I.

Soil Geochemical Surveys

As part of an exploration program designed to follow-up stream sediment geochemical anomalies, the *Korean Institute of Energy & Resources* (KIER, 1982) established 6 separate grids (labelled A, B, C, D, E & F) to cover the areas of breccia outcrops. A sample grid spacing of 20m x 20m was adopted. Samples were collected from the 'C' soil horizon, at depths of 10-60cm. Each sample was sieved to -80# and approximately 300g of sample collected from each site. A total of 1,491 samples were collected and the samples analyzed using AAS for Cu, Pb and Zn at the KIGAM laboratory in Daejeon. The results were statistically treated and anomalous threshold values for the elements were determined as >54ppm Cu, >500ppm Pb and 350ppm Zn.

A total of 16 geochemical anomalies were identified, including **A**, **B**, **C**, **D**, **E**, **F**, **G**, **H**, **I**, **J**, **K**, **L**, **M**, **N**, **O** and **P**. These anomalous zones were plotted on the following geochemical maps for each soil grid and results summarized in the Table below. Significant results are highlighted in red, with maximum results of 3500ppm Cu, 6720ppm Pb and 2200ppm Zn recorded.



Soil Geochemistry Compilation Map. The anomalous soil zones are outlined (red = Cu, blue = Pb and purple = Zn) with the outcropping breccias highlighted in green. Coincidental multi-element soil anomalies with mapped breccia outcrops are evident at Anomalies A, B, C, E, F. H, I, J and K.

Historical Drilling Results

KIER (1982) drilled 12 diamond core holes (No's JD-1, JD-2... to JD-12) for a total of 1,524m of BQ core (hole locations presented below). Hole JD-10 was a vertical hole, the other holes were drilled at various dip angles. The drill holes were sited to mainly test the breccia outcrops at 5 of the 16 soil geochemical anomalies, including **Anomaly B** (holes JD-10, 11 & 12), **Anomaly C** (hole JD-9), **Anomaly E** (holes JD-5, 6, 7 & 8), **Anomaly G** (hole JD-4) and **Anomaly I** (holes JD-1, 2 & 3)



Drill Hole Location Map, Jangheung project. The drillhole numbers are highlighted in red (Prefix JD omitted). The mapped breccia outcrops are shown in green with brown dots. The Soil Geochemical Anomalies are labelled A-P. Drill results indicate Anomalies B and I are Zn-enriched breccias, whilst Anomaly E is Cu-enriched.

Table. Drill Hole Database of Sample Geology & Assay Results (KIER, 1982).

Drillhole	From (m)	To (m)	Geology	Interval (m)	Cu (%)	Pb (%)	Zn (%)	CuEq (%)
JD-1	23.00	28.60	Diorite porphyry	5.60	0.16	2.85	7.40	4.10
JD-1	28.60	31.20	Diorite porphyry	2.60	0.03	0.49	0.75	0.50
JD-1	31.20	34.60	Diorite porphyry	3.40	0.06	0.20	0.30	0.25
JD-1	34.60	39.80	Diorite porphyry	5.20	0.03	0.20	0.30	0.22
JD-1	39.80	55.60	Diorite porphyry	15.80	0.05	0.92	1.07	0.80
JD-1	55.80	56.60	Diorite porphyry	0.80	0.02	0.20	0.20	0.17
JD-1	56.60	58.20	Diorite porphyry	1.60	0.05	1.42	2.24	1.44
JD-1	80.50	80.90	Fault	0.40	0.07	2.09	1.44	1.39
JD-1	80.90	84.50	Sulphide vein	3.60	0.12	4.51	6.50	4.30
JD-2	38.00	42.20	Altered & mineralized gneiss	4.20	0.15	2.12	4.20	2.57
JD-2	42.20	42.80	Altered & mineralized gneiss	0.60	0.13	2.27	5.16	2.98
JD-2	64.40	68.20	Diorite porphyry	3.80	0.07	2.09	3.72	2.29
JD-2	68.20	76.40	Diorite porphyry	8.20	0.02	0.31	0.85	0.47
JD-2	76.40	82.50	Diorite porphyry	6.10	0.06	0.20	0.42	0.30
JD-2	82.50	98.50	Dionte porpriyry	16.00	0.08	0.84	0.98	0.77
JD-3	19.00	21.00	Diarita paraburu	2.00	0.21	2.12	3.34	3.37
JD-3	50.50	54.50	Diorite porphyry	4.00	0.06	1.02	2.40	1.39
JD-3	94.00	99.00	Foult	0.30	0.03	0.62	1.31	0.04
JD-4	43.00	50.00	Mineralized Breccia	7.00	0.04	2 70	1.74	1.80
JD-6	43.00 81.60	82.00	Fault in gneiss	0.40	0.10	0.08	1.50	0.64
1D-6	93.00	93.40	Fault in gnoiss	0.40	0.02	1.00	0.90	0.73
JD-7	16.00	24.00	Diorite porphyry	8.00	1 27	6.03	4 80	5 32
JD-7	42.00	52 50	Mineralized Breccia	10.50	0.13	2.21	2.05	1.73
JD-7	52.50	61.50	Diorite porphyry	9.00	1.10	1.27	2.20	2.42
JD-7	74.00	74.20	Fault in gneiss	0.20	0.01	0.60	0.60	0.46
JD-7	99.00	100.00	Diorite porphyry	1.00	0.02	0.60	0.72	0.52
JD-7	112.70	115.70	Diorite porphyry	3.00	0.02	0.21	0.61	0.34
JD-8	27.00	28.60	Altered & Mineralized gneiss	1.60	0.13	2.21	2.05	1.73
JD-8	32.00	35.00	Altered gneiss	3.00	0.10	1.27	1.34	1.08
JD-8	36.70	39.10	Mineralized Breccia	2.40	0.15	1.15	1.40	1.11
JD-8	39.10	48.70	Mineralized Breccia	9.60	0.16	1.14	1.42	1.13
JD-8	51.00	52.30	Mineralized Breccia	1.30	1.73	3.48	6.35	5.48
JD-8	63.00	76.50	Mineralized Breccia	13.50	0.10	0.40	2.50	1.23
JD-9	18.80	19.50	Gneiss	0.70	0.10	0.75	1.75	1.06
JD-9	26.00	26.20	Altered gneiss	0.20	0.05	0.10	0.30	0.20
JD-9	40.00	41.30	Sulphide vein	1.30	0.27	1.60	2.90	1.99
JD-9	57.80	58.20	Gneiss	0.40	0.10	0.20	0.50	0.37
JD-10	0.00	13.20	Mineralized Breccia	13.20	0.10	0.44	3.30	1.56
JD-10	13.20	25.30	Mineralized Breccia	12.10	0.13	0.60	2.40	1.29
JD-10	25.50	39.50	Mineralized Breccia	14.00	0.30	0.21	6.05	2.76
JD-10	39.50	52.00	Mineralized Breccia	12.50	0.00	0.11	6.00	3.01
JD-10 ID-10	52.00 67.00	80.50	Mineralized Breccia	13.50	0.30	0.15	5.50 4 20	2.52
JD-10	80.50	92 70	Mineralized Breccia	12.30	0.40	0.10	7 10	2.09
JD-10	92 70	106 50	Mineralized Breccia	13.80	0.30	0.40	5 21	2 30
JD-10	106 50	120.00	Mineralized Breccia	13.50	0.30	0.10	3.60	1.71
JD-10	120.00	138.00	Mineralized Breccia	18.00	1.13	0.44	5.73	3.55
JD-10	138.00	146.20	Mineralized Breccia	8.20	0.26	0.10	3.70	1.76
JD-10	150.00	151.70	Mineralized Breccia	1.70	0.40	0.10	6.30	2.92
JD-11	33.00	47.00	Mineralized Breccia	14.00	0.02	0.05	4.80	1.93
JD-11	47.00	59.90	Mineralized Breccia	12.90	0.23	0.10	2.95	1.43
JD-11	59.90	72.00	Mineralized Breccia	12.10	0.26	0.10	3.26	1.58
JD-11	72.00	84.70	Mineralized Breccia	12.70	0.30	0.10	3.70	1.80
JD-11	84.70	102.00	Altered gneiss	17.30	0.24	0.10	3.81	1.78
JD-11	142.00	143.00	Altered gneiss	1.00	0.02	0.10	1.10	0.49
JD-12	34.00	34.20	Gneiss	0.20	0.11	0.05	3.75	1.61
JD-12	57.00	58.70	Altered gneiss	1.70	9.33	0.45	3.65	10.93
JD-12	70.60	78.70	Mineralized Breccia	8.10	0.45	0.34	4.20	2.23
JD-12	80.20	92.20	Mineralized Breccia	12.00	0.22	0.10	3.81	1.76
JD-12	92.20	105.00	Mineralized Breccia	12.80	0.25	0.20	3.10	1.54
JD-12	177.00	177.20	Gneiss	0.20	0.15	0.11	1.05	0.60
JD-12	181.10	182.30	Gneiss	1.20	0.20	0.10	2.90	1.38

Anomaly A

Anomaly A has a 60m x 10m breccia outcrop orientated NW, with a coincidental 80m x 50m weak Cu-Pb soil geochemical anomaly. The Pb soil geochemistry suggests Anomaly A may potentially be linked at depth with Anomaly B.

Anomaly **B**

Anomaly B displays a 150m x 150m strong Cu-Pb-Zn soil anomaly. It has an elliptical-shaped breccia outcrop with150m diameter at surface, perhaps with some WNW structural control.

It was drill tested by KIER (1982) with holes JD-10, JD-11 and JD-12. The drilling confirmed the outcrop at Anomaly B is a breccia pipe with an inverted cone, carrot-shaped morphology.

Excellent results were recorded from the 3 drillholes at Anomaly B, including 146.2m @ 2.45% CuEq. The drill results suggest Anomaly B has an Exploration Target of at least 3Mt size grading 1.0-2.5% CuEq.

Anomaly B is the largest breccia pipe mapped at Jangheung. It is a high-priority Exploration Target and additional geophysical surveys and drill testing is warranted in this area.

JD-10

JD-12

146m @ 2.45% CuEq

EOH 150m



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EOH 203m

Anomaly D

Anomaly D has a 25m x 25m breccia outcrop and a coincidental 50m x 10m weak Cu-Pb soil anomaly. A NW-striking mafic dyke (diorite porphyry?) lies to the NW of Anomaly D. Anomaly D was not drill tested by KIER.

Anomaly E

The 75m x 50m breccia outcrop at Anomaly E has a coincidental very strong Cu-Pb-Zn geochemical anomaly over a 200m x 150m area which is connected to Anomaly F.

Anomaly E was tested by drill holes JD-5, JD-6, JD-7 and JD-8, with good intercepts reported in all drill holes except JD-6. The copper assays are particularly noteworthy and indicate the Anomaly E breccia pipe is Cu-enriched compared to the other more Zn-dominant pipes. Mineralized diorite porphyry was intersected on the margin of the breccia pipe.



A 5m deep prospecting pit was excavated at Anomaly E and a bulk sample of high-grade breccia ore material collected for metallurgical testwork (KIER, 1982) which assayed 143g/t Ag, 5.43% Pb, 4.30% Zn, 1.12% Cu, 1.68% Mn.

Anomaly E is regarded as the highest ranked priority target at Jangheung. Additional geophysical surveys and further drill testing is warranted in this area.

Anomaly F

Anomaly F has a 60m x 50m breccia outcrop, with coincidental strong Cu-Pb-Zn soil geochemical anomaly that is connected to Anomaly E.



Anomaly F was not drill-tested by KIER.

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Anomaly H

Anomaly H has a 150m x 100m breccia outcrop that exhibits some ENE structural control towards Anomaly I, located about 200m to WSW. A 150m x 100m area of weak Cu-Pb-Zn soil geochemical anomalism is coincidental with the breccia outcrop and a strong EW trending VLF-EM geophysical anomaly. Anomaly H was not drill tested by KIER.

Anomaly I

Anomaly I consists of a 100m x 100m breccia outcrop and a coincidental 100m x 100m area of very strong Cu-Pb-Zn soil geochemical anomalism.

A strong ENE trending VLF-EM geophysical anomaly lies immediately north of the breccia. There is also a NNE trending magnetic low feature immediately to the west of the breccia.



Drill Plan Anomaly I. The soil geochemical anomalies are shown (Cu = red line, Pb = blue line & Zn = grey line), along with breccia pipe outcrops in green. The Drill Section is shown as the purple arrowed line.

The breccia outcrop was tested by drill holes JD-1, JD-2 and JD-3. Thick Zn-dominant mineralization was intercepted in all holes, associated with stockworks and disseminations within a diorite porphyry intrusion (best result of 6m @ 4.10% CuEq).

Anomaly I is a priority Exploration Target. Geophysical surveys and further drill testing is warranted-recommended in this area.

Anomaly J

Anomaly J has a small 30m x 20m outcrop of breccia and a coincidental small 50m x 25m weak Cu-Pb-Zn soil geochemical anomaly.

Anomaly J was not drill tested.



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