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MEMO

Re: Engebo Resource Model Update
Date: 5th June, 2018
To: Steinar Kleppe, Ivar Fossum
From: Adam Wheeler

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1 SUMMARY

This memo describes the recent update to the Engebo resource block model. The principal aspects of this update are:

- Data from additional 10 drillholes from 2018 drilling campaign.
- Additional import of logged ORETYPE for 2016 and 2018 core.
- Updated eclogite interpretation with updated database, and reappraisal of all data.
- Updated garnet quantification, based on Fe₂O₃, Al₂O₃, MnO and Na₂O.
- Updated geostatistics and estimation parameters.
- Updated topographical model.
- Additional extrapolation of ORETYPE codings.
- Updated resource classification.
- Resource model update and evaluation.
- Model regularisation, in preparation for Hatch.

Key tables associated with this update are shown in the accompanying pages. The final model file contains the same fields as the previous 2016 resource model, with the addition of ORETYPE and those additional fields associated with the garnet update (Al₂O₃, MnO and Na₂O). A summary of the total in-situ resources is shown in Table 1, along with a comparison of the previous September 2016 resources.

A series of updated sections through the deposit have been prepared, showing TiO₂, rocktype, oretype and resource classification.

Table 1. In-Situ Resource Evaluation

Sep-16 PFS				
TiO ₂ Cut-Off	CLASS	Tonnes Mt	TiO ₂ %	GNT %
3%	<i>Measured</i>	15.0	3.97	44.6
	<i>Indicated</i>	77.5	3.87	43.6
	<i>Measured + Indicated</i>	92.5	3.89	43.7
	<i>Inferred</i>	138.4	3.86	43.5
TiO ₂ Cut-Off	CLASS	Tonnes Mt	TiO ₂ %	GNT %
2%	<i>Measured</i>	19.0	3.68	43.9
	<i>Indicated</i>	105.7	3.51	43.0
	<i>Measured + Indicated</i>	124.7	3.53	43.2
	<i>Inferred</i>	254.5	3.22	42.5

June 4th, 2018; Estmod18_v5				
TiO ₂ Cut-Off	CLASS	Tonnes Mt	TiO ₂ %	GNT %
3%	<i>Measured</i>	22.3	3.95	44.9
	<i>Indicated</i>	75.2	3.85	44.2
	<i>Measured + Indicated</i>	97.5	3.87	44.4
	<i>Inferred</i>	132.2	3.82	42.5
TiO ₂ Cut-Off	CLASS	Tonnes Mt	TiO ₂ %	GNT %
2%	<i>Measured</i>	29.6	3.61	43.5
	<i>Indicated</i>	102.1	3.49	42.8
	<i>Measured + Indicated</i>	131.6	3.51	42.9
	<i>Inferred</i>	255.8	3.15	40.1

Notes

- . Grades above are for total TiO₂
- . Resources below sea-level are limited to a boundary 50m from edge of fjord

2 DATABASE

A summary of the updated database is shown below, reflecting the additional samples from the 2018 drilling campaign.

Table 2. Summary of 2018 Drilling Campaign

	Planned			Actual		
Primary Purpose	No. Of Holes	Length	Average Length/ Hole	No. Of Holes	Length	Average Length/ Hole
		<i>m</i>	<i>m</i>		<i>m</i>	<i>m</i>
Resources	6	766	128	6	751	125
Geotec	4	821	205	4	830	208
Total	10	1,587	159	10	1,581	158

Table 3. Summary of Sample Database

Origin	Type	Holes	Length	Length /Hole	Samples
			<i>m</i>	<i>m</i>	
1995-97	Drillholes	49	15,198	310	36,295
	Surface Samples				1,359
	Tunnel		660		33
2016	Drillholes	38	6,348	167	1,440
	Surface Samples				79
2018	Drillholes	10	1,586	159	367
Total	Total	97	23,791	245	39,573

Table 4. Summary of ORETYPE Definitions

Ore Type	Description
Ferro_1	Intermediate grained ferro eclogite with a moderate content of TiO ₂ . Amphibole porphyroblasts.
Ferro_2	Fresh eclogite, minor alteration. Distinct green and red mineral colors. High grade rutile and garnet ore. Typically coarse grained rock.
Ferro_3	Ferro eclogite with high mica content and some amphibole porphyroblasts.
Ferro_4	Fresh looking eclogite with fine grain size. High rutile and garnet content.
Ferro_5	Typically fresh looking ferro eclogite with distinct mineral banding.
Ferro_6	Darker looking eclogite. Garnets are not very distinct. TiO ₂ from 3-4%. Finer grain size. Abundant retrofractures
Trans_1	Dull looking transitional eclogite. More abundant felsic minerals like quartz and mica. Most often amphibole porphyroblasts
Trans_2	Dull looking transitional eclogite with less felsic content than low grade transitional eclogite. Most often amphibole porphyroblasts.

3 GEOSTATISTICS

Table 5. Statistical Summary of Selected Data

FIELD	ZONE	NUMBER	MINIMUM	MAXIMUM	MEAN	VARIANCE	STANDDEV	COVARTN%
TIO2	1	6,567	0	9.65	1.10	0.41	0.64	58.0
TIO2	2	9,256	0	10.56	2.41	0.68	0.83	34.3
TIO2	3	26,253	0	13.13	3.84	1.65	1.28	33.5
FE2O3	1	6,436	0	29.7	11.30	9.84	3.14	27.8
FE2O3	2	9,222	0	36.1	15.89	11.89	3.45	21.7
FE2O3	3	25,149	0	47.672	17.40	10.52	3.24	18.6
DENSITY	1	165	2.67	3.53	3.16	0.02	0.16	5.0
DENSITY	2	111	2.87	3.77	3.44	0.02	0.16	4.6
DENSITY	3	184	3.03	3.68	3.54	0.01	0.09	2.6
Al2O3	1	1,518	8.8	20.4	16.1	2.37	1.54	9.6
Al2O3	2	1,775	10.7	19.0	15.1	1.58	1.26	8.3
Al2O3	3	2,590	5.5	21.6	13.7	0.63	0.79	5.8
MnO	1	1,518	0.01	0.28	0.16	0.00	0.03	20.2
MnO	2	1,775	0.02	0.34	0.18	0.00	0.03	18.4
MnO	3	2,590	0.03	0.36	0.22	0.00	0.02	9.4
Na2O	1	1,518	0.8	4.07	2.56	0.18	0.42	16.5
Na2O	2	1,775	1.36	4.24	2.55	0.10	0.31	12.3
Na2O	3	2,590	0.56	4.07	2.42	0.05	0.21	8.8
TIO2ILM	1	308	0.89	40.93	7.40	58.88	7.67	103.7
TIO2ILM	2	732	0.63	38.19	6.53	31.55	5.62	86.0
TIO2ILM	3	982	0.53	37.28	5.75	29.15	5.40	93.9

Zone

- 1** **Leuco**
- 2** **Trans**
- 3** **Ferro**

Table 6. Statistical Summary of 5m Composites

FIELD	ZONE	NUMBER	MINIMUM	MAXIMUM	MEAN	VARIANCE	STANDDEV	COVARTN%
TiO2	1	1308	0.00	4.00	1.06	0.25	0.50	46.7
TiO2	2	1241	0.20	5.30	2.38	0.39	0.63	26.4
TiO2	3	3100	0.01	6.80	3.80	0.92	0.96	25.2
FE2O3	1	1293	0.03	18.80	11.23	6.54	2.56	22.8
FE2O3	2	1235	0.00	26.00	15.80	6.69	2.59	16.4
FE2O3	3	2992	0.12	24.09	17.36	4.78	2.19	12.6
Al2O3	1	505	10.28	20.37	16.10	2.09	1.44	9.0
Al2O3	2	392	11.19	18.97	15.10	1.39	1.18	7.8
Al2O3	3	656	6.59	21.56	13.74	0.46	0.68	4.9
MnO	1	505	0.02	0.27	0.16	0.00	0.03	18.5
MnO	2	392	0.08	0.34	0.18	0.00	0.03	17.0
MnO	3	656	0.09	0.36	0.22	0.00	0.02	8.3
Na2O	1	505	0.98	3.77	2.56	0.15	0.38	14.9
Na2O	2	392	1.69	4.00	2.55	0.08	0.28	10.8
Na2O	3	656	1.08	4.07	2.42	0.03	0.18	7.4
TiO2ILM	1	142	0.89	32.80	7.37	45.60	6.75	91.6
TiO2ILM	2	218	0.63	38.19	6.40	27.77	5.27	82.3
TiO2ILM	3	372	0.53	37.28	5.68	25.03	5.00	88.0

Figure 1. Box Plots of Selected Sample Data

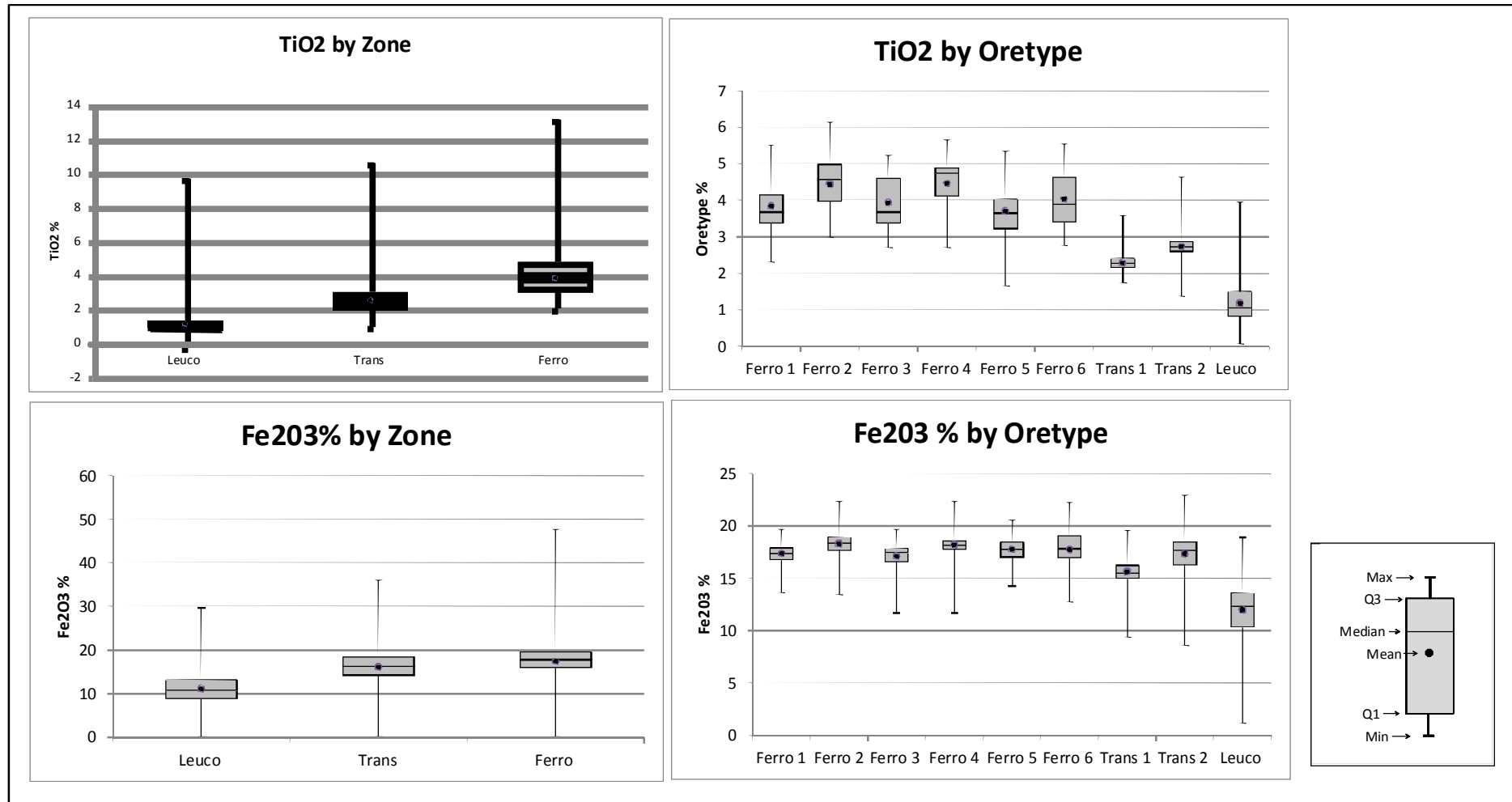


Figure 2. Box Plots of 5m Composites

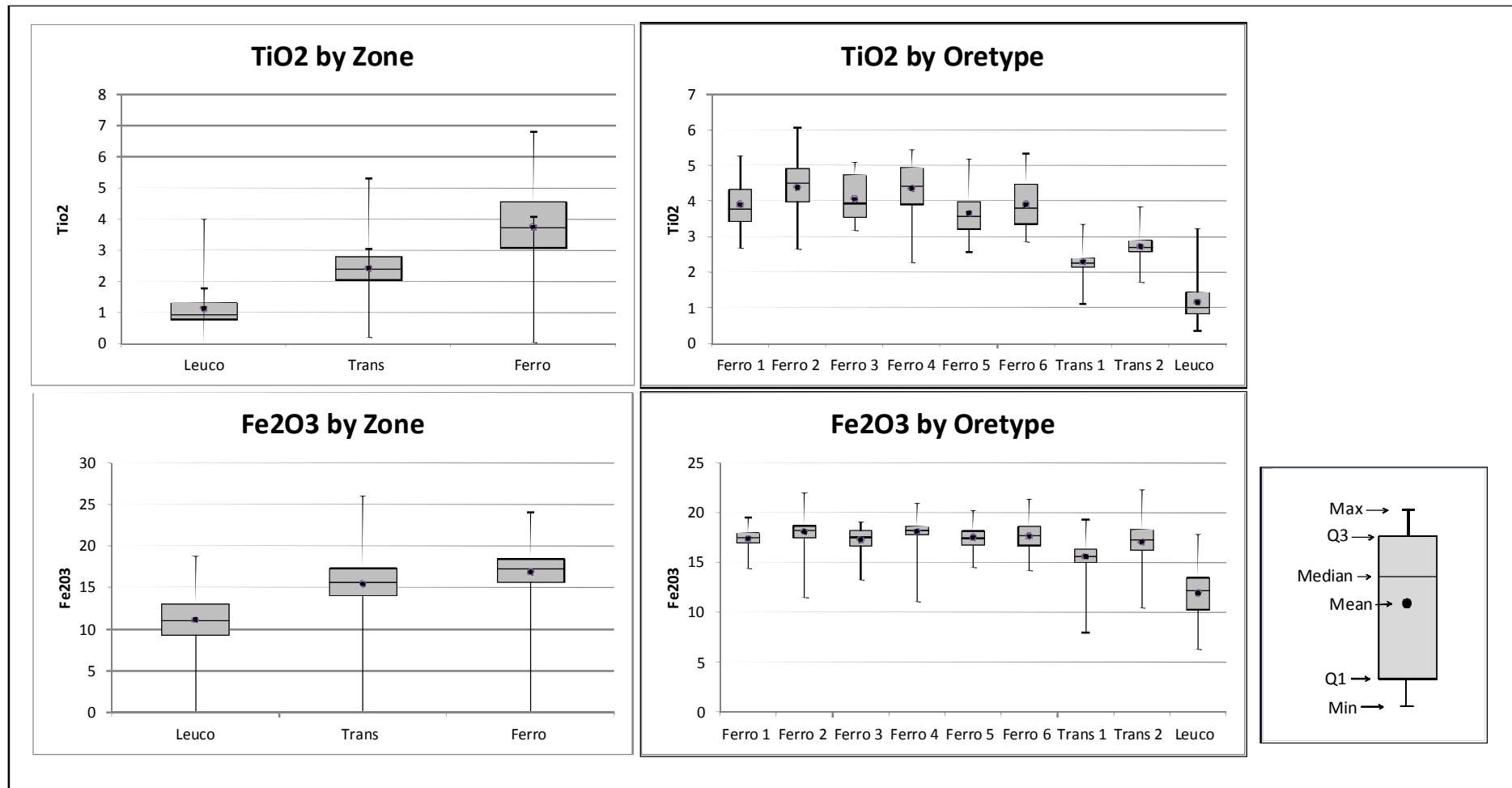


Figure 3. Boxplots of Density Values

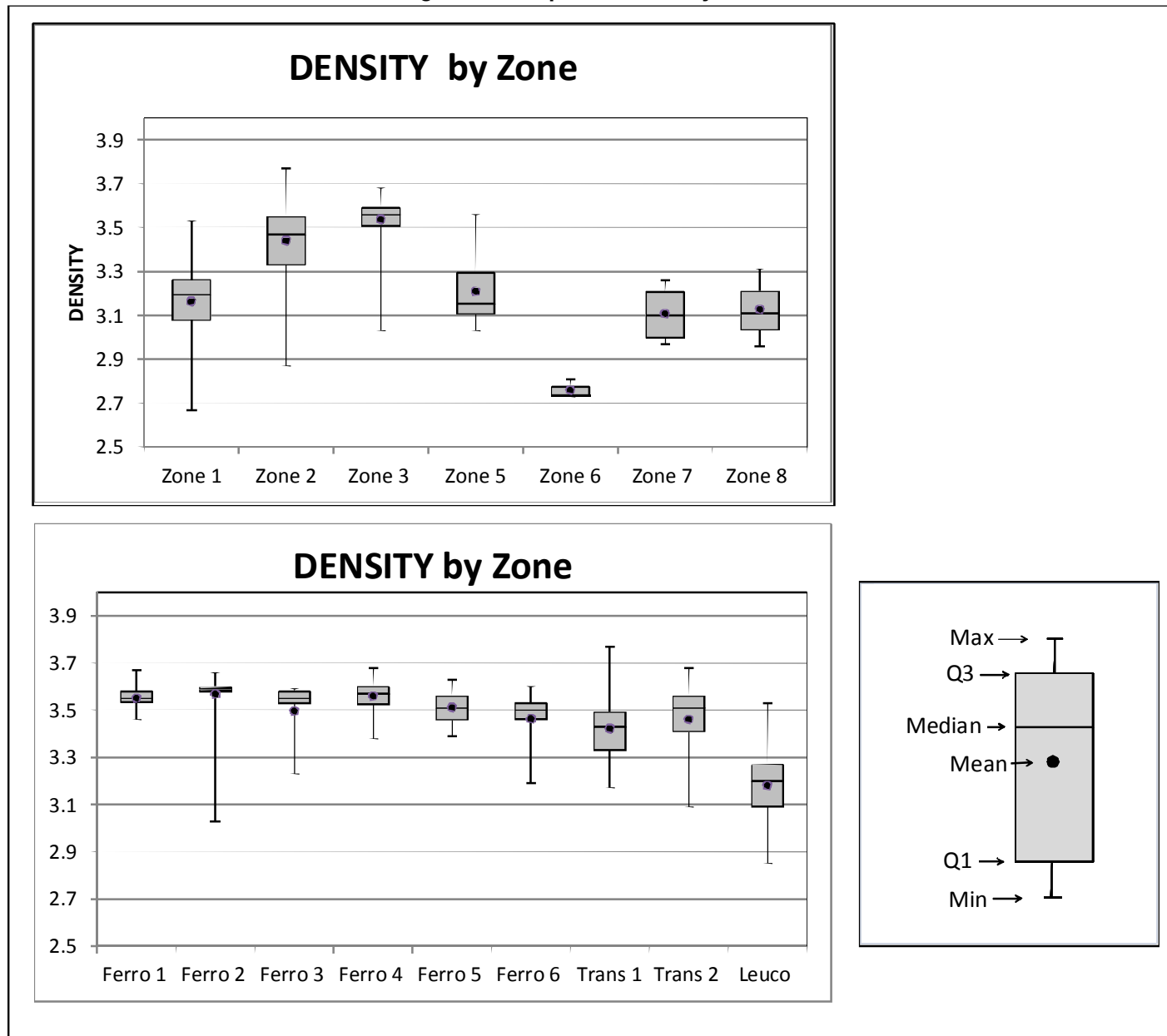
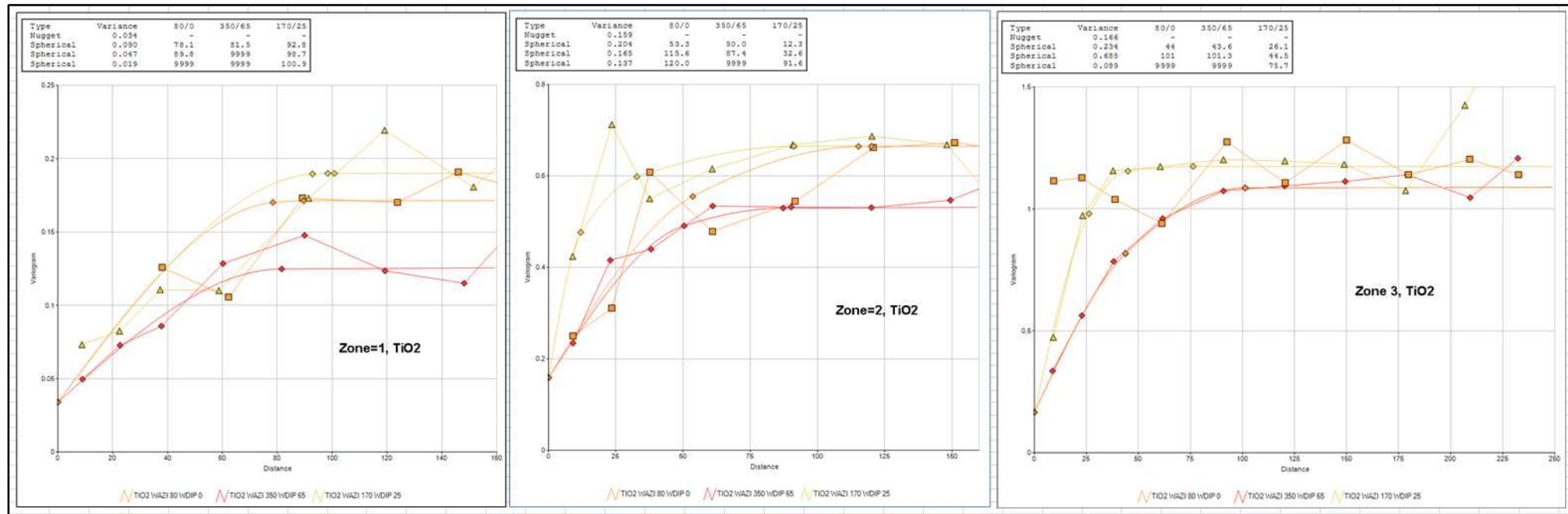


Figure 4. Experimental and Model Variograms



4 GRADE ESTIMATION

Table 7. Grade Estimation Parameters

Field	Zone	Distances X:Y:Z (m)			Search	Minimum Composites	Maximum Composites	Minimum No. of Drillholes
		1	2	3				
TiO ₂	Leuco-Eclogite	60	60	15	1st	11	25	3
		80	80	20	2nd	11	25	3
		120	120	30	3rd	4	15	2
	Trans-Eclogite	60	60	15	1st	11	25	3
		102	102	26	2nd	11	25	3
		120	120	30	3rd	4	15	2
	Ferro-Eclogite	60	60	15	1st	11	25	3
		102	102	26	2nd	11	25	3
		120	120	30	3rd	4	15	2
Other Grades	All Zones	60	60	36	1st	3	15	-
		120	120	72	2nd	1	15	-
		288	288	173	3rd	1	15	-
	Notes:							
		. Directions determined locally using dynamic anisotropy:						
			X: Along-Strike					
			Y: Down-Dip					
			Z: Cross-Strike					
		. All TiO2 and Fe2O3 grades interpolated using ordinary kriging, in main eclogite zones						
		. All other grades interpolated using inverse distance weighting (^2)						
		. Other grades estimated:						
			Al2O3					
			SO3					
			SiO2					
			MnO					
			NaO					
			RQD					
			FRACPERM					
			TiO2ILM					
			DENSITY					

Table 8. Resource Evaluation Summary

June 4th, 2018; Estmod18_v5				
TiO ₂ Cut-Off	CLASS	Tonnes Mt	TiO ₂ %	GNT %
3%	<i>Measured</i>	22.3	3.95	44.9
	<i>Indicated</i>	75.2	3.85	44.2
	<i>Measured + Indicated</i>	97.5	3.87	44.4
	<i>Inferred</i>	132.2	3.82	42.5
TiO ₂ Cut-Off	CLASS	Tonnes Mt	TiO ₂ %	GNT %
2%	<i>Measured</i>	29.6	3.61	43.5
	<i>Indicated</i>	102.1	3.49	42.8
	<i>Measured + Indicated</i>	131.6	3.51	42.9
	<i>Inferred</i>	255.8	3.15	40.1

Notes

- . Grades above are for total TiO₂
- . Resources below sea-level are limited to a boundary 50m from edge of fjord

Table 9. Grade-Tonnage Table - In-Situ Overall Measured and Indicated Resources

TiO ₂ Cut-Off	Tonnes	TiO ₂	GNT
%	Mt	%	%
1.0	148	3.27	40.8
1.1	145	3.33	41.3
1.2	142	3.37	41.7
1.3	140	3.40	42.0
1.4	138	3.43	42.2
1.5	137	3.45	42.4
1.6	136	3.46	42.5
1.7	135	3.47	42.6
1.8	134	3.48	42.7
1.9	133	3.49	42.8
2.0	132	3.51	42.9
2.1	129	3.54	43.1
2.2	126	3.58	43.3
2.3	122	3.62	43.4
2.4	118	3.67	43.6
2.5	113	3.71	43.8
2.6	109	3.76	43.9
2.7	106	3.79	44.0
2.8	104	3.82	44.1
2.9	101	3.84	44.3
3.0	98	3.87	44.4
3.1	94	3.90	44.5
3.2	89	3.94	44.6
3.3	84	3.99	44.8
3.4	78	4.03	44.8
3.5	72	4.08	44.9

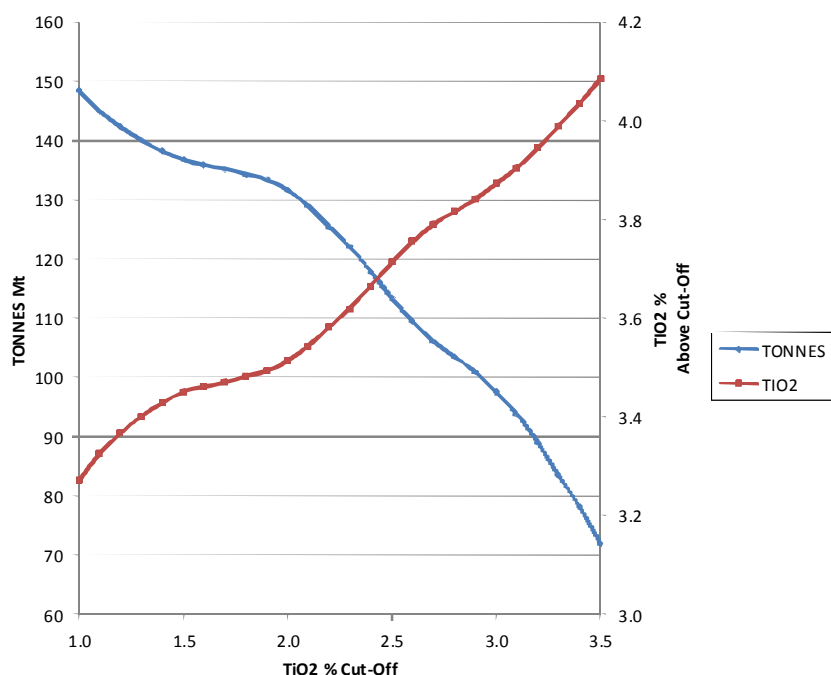
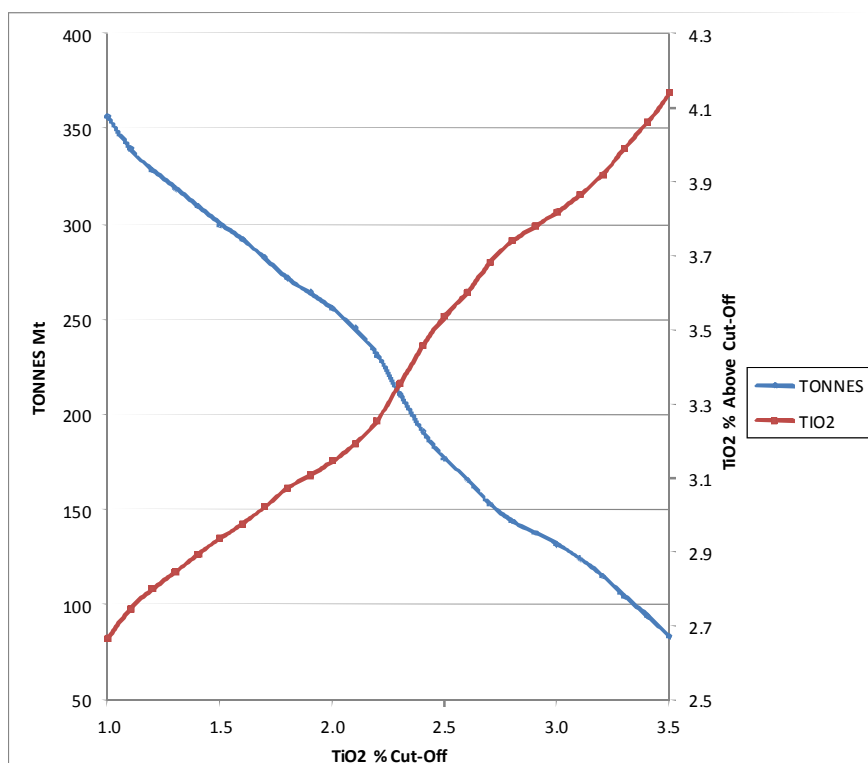


Table 10. Grade-Tonnage Table - In-Situ Overall Inferred Resources

TiO ₂ Cut-Off	Tonnes	TiO ₂	GNT
%	Mt	%	%
1.0	356	2.67	35.7
1.1	339	2.75	36.5
1.2	328	2.80	37.2
1.3	319	2.85	37.7
1.4	309	2.89	38.2
1.5	300	2.94	38.5
1.6	292	2.98	38.8
1.7	282	3.02	39.2
1.8	271	3.07	39.6
1.9	264	3.11	39.8
2.0	256	3.15	40.1
2.1	245	3.19	40.4
2.2	231	3.26	40.7
2.3	210	3.36	41.2
2.4	191	3.46	41.5
2.5	177	3.54	41.7
2.6	166	3.60	41.9
2.7	153	3.68	42.0
2.8	144	3.74	42.1
2.9	138	3.78	42.3
3.0	132	3.82	42.5
3.1	124	3.87	42.8
3.2	116	3.92	43.1
3.3	104	3.99	43.5
3.4	94	4.06	43.7
3.5	83	4.14	44.1



5 MODEL REGULARISATION

As previously, the block model was the regularised to 15m x 15m x 15m block size, in order for Hatch to proceed with their optimisation and pit planning work.

Table 11. Evaluation of Regularised Model

June 4th, 2018 Regmod_v5				
TiO ₂	CLASS	Tonnes	TiO ₂	GNT
Cut-Off		Mt	%	%
3%	<i>Measured</i>	22.6	3.87	44.3
	<i>Indicated</i>	74.4	3.80	43.9
	<i>Measured + Indicated</i>	97.0	3.82	44.0
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