Cradle Resources

MIRABAUD 1819

Mining Research

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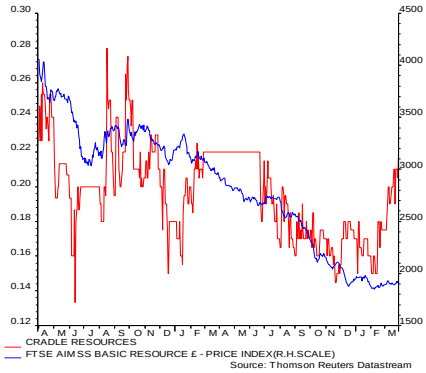
Speculative Buy

Ticker	CXX AU
Share Price (A$)	0.22
Target Price (A$)	0.56
Upside (%)	155%
12mth high/low (A$)	0.24/0.13
Shares out (m)	128.7
Market Cap (A$m)	28.3
Enterprise Value (A$m)	25.6



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Panda Hill PFS firms up project economics

Cradle today announces the results from the prefeasibility study (PFS) of its Panda Hill niobium (Nb) project in Tanzania, following a recent (20 January 2015) update in its resource base (96.3Mt at 0.52% Nb_2O_5 for 504kt of contained Nb_2O_5). The PFS provides a more in-depth technical review, representing a significant milestone.

Cradle's PFS is based on the scoping study base-case scenario of a 2Mtpa open-pit operation. However, we note the company's intention to adopt a less aggressive entry strategy into the highly concentrated market for niobium supply, by maintaining a long-term FeNb production profile at ~5% of world production (currently totalling ~130ktpa – see p11).

Cradle advises that the definitive feasibility study (DFS), which is currently under way, will focus on a 1Mtpa processing plant scenario with the option to expand to at least 2Mtpa, which we assume will take place after the first five years of production. Consequently, we are expecting that the DFS will show a low-capex, low-technical-risk and quicker route to production for Panda Hill (the most advanced developing Nb project in the world) while maintaining its robust economics.

This expected smaller initial scale (1Mtpa) compared with the PFS (2Mtpa) should come with significantly lower initial capex requirements (we assume ~US$144m for Stage I and US$81m for Stage II in year five) compared with company's PFS initial capex requirements of US$195m (incl. working capital). The latter, along with the completion of the PFS which will result in higher confidence in the project economics, will significantly de-risk the project.

DFS completion and project financing in H2 2015

The DFS, along with the project's funding arrangements, should be completed in around 7-9 months (Q4 2015), and on this schedule we believe construction could commence in H1 2016 (until which stage both Cradle and the project are fully funded), facilitating first production in Q1 2018 and full plant commissioning in late-CY2018.

We value Cradle on a sum-of-the-parts basis, incorporating a risk-adjusted NPV estimate of Panda Hill on a Cradle-attributable basis (50%), using the operating and cost parameters from the project's prefeasibility study adjusted to fit our staged ramp-up approach which we believe will be in-line with Cradle's final plan. We are relaxing the risk weighting we apply to our valuation of Panda Hill to 55% (vs. 65% previously), to reflect the high confidence of the PFS. As Cradle further de-risks the project moving towards the full-feasibility study and construction decision, we would expect the share price to begin reflecting more of Panda Hill's undoubted potential. **Our revised valuation of A$0.56, offers 155% upside to Cradle's current share price and we therefore retain our stance at SPECULATIVE BUY.**

Mirabaud's view: staged approach

Cradle to retain its production levels at ~5% of world production

Although in the PFS Cradle reiterates its intention to proceed with the 2Mtpa throughput outlined in the scoping study base-case scenario, the company advises that the DFS will focus on a 1Mtpa processing plant scenario which will potentially be expanded to at least 2Mtpa. This approach is designed to maintain a FeNb production profile (~4.5ktpa of FeNb according to our estimates) at ~5.0% (we estimate it at ~4% in the early years) of world production (currently at ~130ktpa of FeNb), which the company considers to be a smoother enter into the concentrated niobium market.

We consider this staged approach similar to the scoping study staged development scenario (initial scale of 1Mtpa expanding to 2.3Mtpa after the first 3 years of production), without stating a particular time frame for the expansion.

Staged approach - Cradle's preferred option to proceed

For the purpose of our model we are assuming that the company will proceed with the Stage II expansion to 2Mtpa (conservative approach) after the first five years of production, which combined with a ramp-up period of ~12 months will result in a full commissioning for the Stage II in CY2024. The plant expansion will almost double the mine's capacity from ~4.5ktpa of FeNb in the first five years to ~9.0ktpa for the next five years (ten-year average of ~6.5ktpa) for a LoM average of ~6.3ktpa of FeNb.

Staged scenario will come with lower initial capex needs

We calculate the capital expenditure needs for our staged scenario based on company's scoping-level staged approach capex estimate of US$196m (US$125m for phase 1 and US$71m for phase 2). However, due to the lower accuracy of the scoping study (30% vs. 20% in PFS) we are using a more conservative approach (15% higher) of ~US$225m (including working capital) comprising 64% (or US$144m) for Stage I and 36% (or US$81m) for stage II (both in today's money).

Stage II (expansion) and other capital requirements will be funded from project's future cash flow

Although its smaller initial scale, the project, due to the well-optimised mining plan (higher grade in early years), will be able to internally fund both the Stage II expansion (~US$80m – in the 5th year of production) as well as the cost for the conversion from HFO to grid power (~US$30m – in the 5th year of production) while serving a relatively high sustaining capital cost (~9% of mine's operating cost - ~US$8.5mpa in today's money).

The changes to our model have resulted in a ~20% decrease in Panda Hill's NPV and a small reduction in the project's IRR (to ~32% from ~36% previously); though we highlight the company's much better understanding of the project, both in terms of the cost structure (capital and operating cost estimates) as well as in the level of detail of geological and engineering studies, as the project advances from conceptual (scoping study) to preliminary (prefeasibility study) to feasibility phase (bankable feasibility study).

The table below presents our current model assumptions and outputs compared with the company's PFS estimates. For comparison purposes we are also including our previous model assumptions (as at 4 February 2015).

Summary of Mirabaud and Cradle cash-flow modelling assumptions and outputs

Item	Unit	Mirabaud - based on PFS (new)	Cradle - PFS (base-case)	Mirabaud - based on Scoping study (old)
Scenario	-	2Mt staged	2Mtpa stable	2Mtpa stable
Mineable resource	Mt	60	60	58
Life-of-mine	Years	32	30	30
Annual mill throughput (first 5 years)	Mt	1.0	2.0	2.0
Annual mill throughput LoM	Mt	1.8	2.0	2.0
Strip-ratio (years 1-10)	X	2.2:1	2.6:1	2.5:1
Strip-ratio (years LoM average)	X	2.3:1	2.3:1	1.3:1
Average Nb_2O_5 head grade (years 1-10)	%	0.70	0.68	0.66
Average Nb_2O_5 head grade (LoM average)	%	0.54	0.54	0.54
Nb recovery to concentrate (years 1-10)	%	63	63	62
Nb recovery to concentrate (LoM average)	%	62	62	62
Nb-in-concentrate production (years 1-5)	Kt	3.0	5.5	5.4
Nb-in-concentrate production (years 6-10)	Kt	5.8		
Nb-in-concentrate production (LoM average)	Kt	4.2	4.5	4.5
FeNb converter recovery (LoM average)	%	97	97	97
FeNb matte (66% Nb grade) product (years 1-5)	Kt	4.5	8.4	8.2
FeNb matte (66% Nb grade) product (years 6-10)	Kt	8.8		
FeNb matte (66% Nb grade) product (LoM average)	kt	6.3	6.8	6.9
Long-term real Nb price	US$/kg	40	44	40
Royalties	%	3	3	3
On-site cash operating costs	US$/kg	20	19	17
Total cash costs (incl transport, marketing costs and royalties)	US$/kg	22	22	19
Annual EBITDA (LoM average)	US$m	85	103	83
Tax rate	%	30	30	30
Initial capex (incl contingency – in today's money)	US$m	144	195	200
Stage II expansion capex (incl contingency – in today's money)		81	-	-
LoM capex (incl sustaining capex – in today's money)	US$m	485	453	295
Post-tax NPV (10% discount rate)	US$m	371*	470	481*
Post-tax IRR	-	32%*	56%	36%*
Payback period	years	3.0	1.5	2.5

Source: Mirabaud Securities estimates

*NPV and IRR calculated on a nominal basis, with revenues and costs inflated at 2.5% pa

PFS shows strong economics

Apart from our staged approach, compared with company's PFS 2Mtpa base-case scenario (see table above), for the first five years of production (as well as the project's lower initial capital expenditure needs), our model is based on company's PFS outputs.

PFS is based on a 2Mtpa open-pit scenario

Cradle's prefeasibility study (PFS) is based on the scoping study base-case scenario of a 2Mtpa open-pit operation, plus the progress the company has made during the last year.

The PFS assumes the same niobium market price of US$44/kg as was used in the scoping study, yielding extremely positive economic results over a 30 year LOM. Cradle calculates a post-tax project IRR of 56.5% and an NPV_{10} of US$470m, indicating wide cash operating margins (>50% representing >US$100m LoM average, US$135m in the early years) and the potential for the upfront capex to be repaid within just 1.5 years (from first production).

Mine design boosts project's economics by increasing Nb grade in the early years…

The PFS allows a better optimised mining plan with access to the higher grade ore in the early years of operation due to a more selective mine plan targeting only the indicated material in the early years (during the payback period), which increases the niobium head grade to a first-ten-year average of ~0.68% of Nb_2O_5 (vs. a LoM average of 0.54% Nb_2O_5). Due to our staged approach we estimate lower plant feed needs in the early years and thus we are assuming an extended first stage pit pushback (high grade ore) which in turn results in a head grade increase to ~0.70% of Nb_2O_5 for the first ten years. Lower grade material (<0.6% of Nb_2O_5) will be stockpiled for later use (after the first ten years).

…though, at the cost of a higher stripping ratio

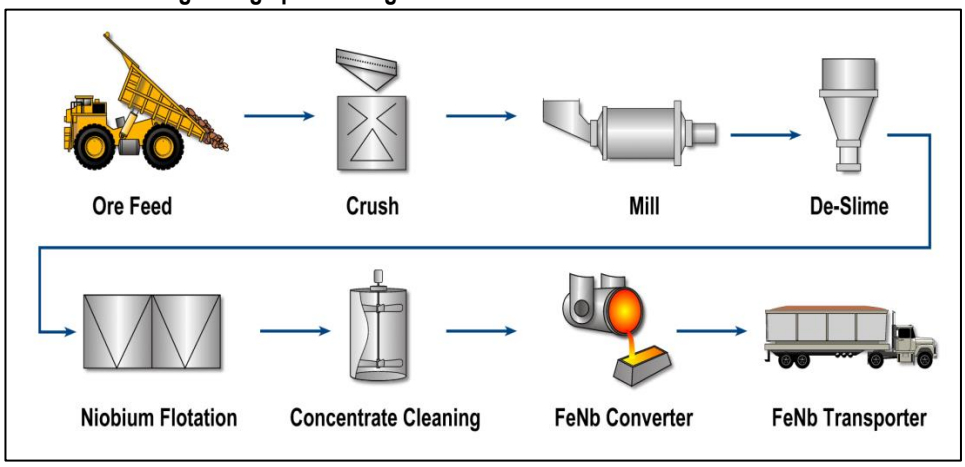
However, this selective mining comes at the cost of a higher-than-initially expected stripping ratio which is now calculated by the company to be ~2.2:1 in the early years (vs. our previous assumption of 2.5:1), increasing to a LoM average of 2.3:1 (vs. the scoping study's 0.4:1 and our previous assumption of 1.3:1). Nevertheless, Panda Hill's stripping remains relatively low, compared with other open-pit mines, due to the favourable geomorphology and the project's deposit geometry.

This increase in the strip-ratio is also the result of a deeper conceptual open-pit shell (Angel Zone – the likely starter pit) as well as the need to remove the weathered cover (which comprises the upper part of the deposit and thus must be mined first) which is uneconomic to treat due to its relatively low metallurgical recoveries (strongly oxidised zone).

We already modelled (in our previous note - 04/02/2015) only half of the weathered material (~6% of total mineable resources) to be processed in the early years (blended with the fresh carbonatite material at a ratio of ~4:16 20%), while we assumed the other half will be stockpiled for future treatment (due to lower recoveries) in case of a more favourable niobium price environment. Although there is potential to upgrade the bulk of this material, by gravity separation, for treatment through the primary material circuit, this will be evaluated at a later stage and thus we are not modelling treatment of the stockpiled weathered material.

Our life-of-mine Nb concentrate recovery assumption, a key sensitivity in our valuation (see p8), remains almost unchanged compared with our previous estimates, to a LoM average of ~62% (from 63% in the first 10 years) in-line with the company's PFS.

Panda Hill's single-stage processing route



Source: Cradle resources

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Single-stage flotation and less use of reagents reduces processing costs

In today's announcement Cradle confirmed its intention to move towards a simpler, single-stage flotation process (Panda Hill mineralisation contains low levels of impurities), with reduced reagent consumption (~40% less than assumed in the scoping study), through which both carbonatite material types (primary and weathered) will be similarly treated (with some grade and recovery variations and minor changes in reagent rates). The flotation circuit will be followed by a two-stage leaching circuit (acid leach followed by an alkaline leach) in order to reduce phosphate and sulphur levels in the concentrate and thus increase recoveries.

Both the simpler direct flotation process and the reduced reagent consumption will positively impact processing costs. However, the mining cost increase due to the increased stripping, more than offsets the processing cost reduction resulting in a higher PFS-level mine cash cost assumption of US$20/kg of Nb (vs. our previous assumption of US$17/kg Nb and the company's LoM forecast of US$19/kg Nb)

National grid power will replace HFO for a ~50% unit cost reduction

Cradle is also considering switching from the current HFO power to national grid power after the fifth year of production at an extra cost of ~US$30m (we account for it in our model). We estimate that while this upgrade will not massively impact project's IRR the NPV of the Panda Hill will be positively affected by ~3% from the cut in power costs, the result of a reduced unit cost by almost 50% (to US$0.115/kWh from US$0.213/kWh previously).

Panda Hill targeted development timetable

Conceptual Schedule - Panda Hill									
Project Activities	**Target End Date**	**H1 2015**	**H2 2015**	**H1 2016**	**H2 2016**	**H1 2017**	**H2 2017**	**H1 2018**	**H2 2018**
Definitive Feasibility Study	November 2015								
Piloting Testwork	July 2015								
Basic Design	October 2015								
Environmental & Social Impact Assessment	July 2015								
Reporting	November 2015								
Front End Engineering	August 2016								
Detailed Design	July 2016								
Procurement	August 2016								
Construction									
Fabrication	May 2017								
Delivery	August 2017								
Construction	December 2017								
Commissioning	February 2018								
Operations									
Ramp-up	December 2018								
Steady State	From Dec 2018								

Source: Cradle Resources

DFS and financing conclusion reduces uncertainty

Panda Hill is one step closer towards unlocking the value of a world-class niobium resource

The results of the prefeasibility study more than justify our faith in the robust nature of the project and enhances our confidence that Cradle will be capable of securing funding to develop the Panda Hill, thus becoming the first primary niobium producer to come on stream since 1976, in a market dominated by only three players (CBMM, Niobec and Catalao).

There is therefore scope for a further upgrade of resources to the indicated and measured category

The DFS work programme is now under way, focusing initially on Panda Hill's new resource model (after the late 2014 drilling) which will result in the optimal mine design and project's cost structure. The DFS, along with the project's funding arrangements, should be completed in around 7-9 months, and on this schedule

we believe construction could commence in Q1 2016, facilitating first production in Q1 2018. The latter, followed by a 12-month ramp-up period (we assume 50% plant availability during CY2016), will result in steady-state production in late-CY2018.

Most of the necessary drilling to advance the project to the point of construction decision has already been completed with the main task remaining being the piloting testwork (optimisation of the conceptual milling and flotation process through pilot testwork at SGS's facilities in Canada which will take place between May and July 2015), engineering and design studies as well as the ESIA certificate issuance (will be submitted by Q2 2015 and with the approval process taking 90 days, Cradle expects it in Q3 2015) which, while time consuming, are relatively inexpensive tasks.

Cradle is fully funded to the point of a construction decision

Cradle estimates total expenditure to the completion of the definitive feasibility study at ~US$5m, which should be met in its entirety by Tremont's (private-equity group) remaining investment (US$10m from a total US$20m investment commitment for an eventual 50% stake in Panda Hill – US$5m of which will be shortly released) if the latter exercises its earn-in rights in full.

We believe that Cradle will have viable funding options that are not solely reliant on equity markets for its 50% project share (we assume that Tremont earns its full 50% stake), which based on our project's initial capital expenditure needs assumption will be ~US$75m.

The lower initial capex assumption (based on our assumed stage approach), along with the completion of the PFS, results in a much better understanding of the project with a level of opex and capex accuracy of ±20% vs. ±30-35% in scoping study level) significantly de-risking the Panda Hill project.

We are relaxing our risk-weight to 55% (from 65% previously)

Consequently, we are relaxing the risk-weighting we currently apply (65% discount) to our valuation of Panda Hill to 55% (thus valuing Cradle's 50% attributable share of Panda Hill at 45% of our attributable NPV estimate). As Cradle further de-risks the project moving towards the full-feasibility study and construction decision, we would expect the share price to begin reflecting more of Panda Hill's undoubted potential.

Upcoming catalysts

Angel Zone resource update (Phase 3)	May CY2015
Piloting testwork	July CY2015
Environmental & social impact assessment (ESIA) certificate	Q3 CY2015
Pit-optimisation (and mine design) completion	H2 CY2015
Project funding	H2 CY2015
Definite feasibility study	Q4 CY2015
Detailed design work	Q1 CY2016
Construction start	Q1 CY2016
Stage I first production expected	Q1 CY2018
Stage I fully commissioned (1Mtpa)	Q4 CY2018
Stage II construction	2022
Stage II fully commissioned (2Mtpa)	2023
Grid replaces HFO	2023

Source: Mirabaud Securities

Valuation

We value Cradle based on our staged approach scenario (from 1Mtpa to 2Mtpa after 5 years of production)

We value Cradle on a sum-of-the-parts basis, incorporating a risk-adjusted NPV estimate of Panda Hill (at a 10% nominal discount rate) on a Cradle-attributable basis (we assume Tremont earns its full 50% by funding the project through definitive feasibility - currently it has contributed US$10m for the first 25% - and that the US$14m estimated option payment for the JV company to take full ownership of the licence is met 50:50 by Cradle and Tremont). **We use our revised operating and cost parameters for our assumed staged approach (from 1Mtpa to 2Mtpa after the first five years of production).**

Our in-house long-term niobium price assumption is US$40/kg

We assume a conservative base-case niobium pricing assumption of US$40/kg in today's money (vs. Roskill's and Camet's long-term forward pricing of US$45/kg of Nb and Cradle's long-term price assumption of US$44/kg of Nb), in-line with the average market price over the past five years (of US$41/kg of Nb ±5% - see p 14). We inflate both revenues and costs at an assumed 2.5% pa.

Our target price is now based on a 55% risk adjustment (vs. 65% previously) to Cradle's 50% attributable share

In arriving at our sum-of-parts valuation of A$0.56/sh, we apply a 55% risk adjustment (down from 65% previously) to Cradle's 50% attributable share of our base-case NPV estimate of Panda Hill in recognition of the risks to first production. One of these is the financing of Cradle's share of the capex (and potential associated equity dilution if funded all, or in part, by equity).

The key changes since our last note (4 February 2015) include our assumption of a smaller initial plant for the first 5-6 years of production (1Mtpa instead of 2Mtpa before), as well as an increase in the project's stripping ratio (to 2.3:1 from 1.3:1 previously) which reduces the positive effect of the smaller risk-adjustment (55% vs. 65% previously). We have also updated the net cash position according to the company's latest (Q2 FY2015) reported cash of ~US$2m.

Cradle Resources – sum-of-parts valuation

	US$m	A$/sh*
Panda Hill, $NPV_{10\%}$ – 50% attributable basis	185	1.65
Risk adjustment - 65% reduction	-102	-0.91
Outstanding ownership payment – 50% attributable basis	-7	-0.06
Project valuation	**76**	**0.68**
Corporate-level costs, $NPV_{10\%}$	-16	-0.14
Net cash (estimate)	2	0.02
Cash from in-the-money options		0.00
Company valuation	**63**	**0.56**

*128.7m current issued shares, plus 18.75 performance shares issuable on completion of positive DFS A$1 = US$0.76
Source: Mirabaud Securities estimates

Our A$0.56/share risked valuation equates to almost ~2.5x times Cradle's current share price, and we therefore retain our recommendation at BUY. We retain the SPECULATIVE qualifier owing to the inherent funding risks.

Project sensitivities

Based on our assumption of a staged approach, we have created a series of sensitivity tables in order to estimate the potential impact of changes to a number of basic variables such as the niobium price and niobium recovery to concentrate where the project is most sensitive, as well as the project's costs (capital and operating expenses).

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The first set of tables below illustrates Panda Hill's NPV and IRR sensitivity to a range of niobium prices (inflating at 2.5% pa along with costs), against and nominal discount rate in the first, and niobium recovery to concentrate in the second table. They both indicate a robust project mainly due its relatively high IRR (~32%) at our conservative niobium pricing assumption (US$40/kg), while offering significant upside on likely higher niobium prices.

Panda Hill NPV (US$m) sensitivity to real Nb price and discount rate

	US$36/kg	US$38/kg	US$40/kg	US$42/kg	US$44/kg	US$46/kg
15.0%	111	140	171	201	230	260
12.5%	171	211	251	290	329	368
10.0%	262	316	**370**	423	477	530
7.5%	403	478	555	630	705	780
5.0%	628	739	851	962	1,073	1,184

Source: Mirabaud Securities estimates

Post-tax Panda Hill IRR sensitivity to real Nb price and Nb recovery to concentrate

	US$36/kg	US$38/kg	US$40/kg	US$42/kg	US$44/kg	US$46/kg
59%	23%	26%	29%	31%	34%	36%
61%	25%	28%	30%	33%	35%	37%
63%	26%	29%	**32%**	34%	36%	39%
65%	27%	30%	33%	35%	38%	40%
67%	29%	31%	34%	36%	39%	41%

Source: Mirabaud Securities estimates

The project is mostly sensitive in primary ore flotation recoveries and Niobium price

From the table below we note that the Panda Hill is sensitive to both Nb recovery and discount rate. For every 1.5% increase (above our ~63% LOM assumption) in recovery rates, we estimate a ~7% increase in our TP (accounting for the project's NPV 55% risk adjustment).

Sensitivity analysis of project's NPV (US$m) to primary ore recovery and discount rate

US$/oz	59%	61%	**63%**	65%	67%	69%
15.0%	138	154	171	187	204	220
12.5%	206	228	251	273	294	316
10.0%	308	339	**370**	400	431	461
7.5%	466	510	555	598	642	685
5.0%	719	785	851	917	982	1047

Source: Mirabaud Securities estimates

Panda Hill proves to be less sensitive in capex and opex variations

On the other hand, we estimate that the project's NPV is less sensitive to the operating cost and capital expenditure assumptions (for both Stage I and Stage II).

Sensitivity analysis of project's NPV (US$m) to capital expenditure and discount rate

US$/oz	US$160m	US$180m	**US$225m**	US$220m	US$240m	US$260m
15.0%	180	175	171	166	162	157
12.5%	260	255	251	245	241	236
10.0%	379	375	**370**	364	360	355
7.5%	564	560	555	549	544	539
5.0%	861	856	851	845	840	835

Source: Mirabaud Securities estimates

Sensitivity analysis of project's NPV (US$m) to OPEX* and discount rate

US$/oz	-15%	-10%	-5%	**0%**	5%	10%
15.0%	205	194	182	171	159	147
12.5%	297	281	266	251	234	219
10.0%	434	413	392	**370**	348	326
7.5%	649	617	586	555	522	491
5.0%	995	947	899	851	802	754

*Based on our assumption: ~US$42/t mill feed – excluding royalties, transport and marketing costs
Source: Mirabaud Securities estimates

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Strong resource base with more to come…

The significant increase in the indicated category came at a higher primary carbonatite grade

Cradle recently reported (20 January 2015) an updated resource estimate, following an in-fill drilling campaign (Phase 1 – June-October) of 72 holes for a total of 9,365m. The resource update resulted in a significant upgrade in confidence levels by increasing the quantity in the indicated category, which is the basis for the prefeasibility. The drilling resulted in a depth extension to the so called Angel Zone (southern region), which hosts a wide high-grade core to the deposit and will offer an attractive starter pit along with a zone to the north of the deposit which will also be mined (see figure below).

Updated 2015 Panda Hill JORC* mineral resources

above 0.3% Nb_2O_5 cut-off	Mt	% Nb_2O_5	Nb_2O_5 (kt)
Weathered carbonatite	5.1	0.59	30
Primary carbonatite	35.9	0.52	194
Sub-total indicated	**41.0**	**0.62**	**224**
Weathered carbonatite	2.8	0.81	15
Primary carbonatite	52.5	0.47	265
Sub-total inferred	**55.3**	**0.51**	**280**
Total weathered carbonatite	7.9	0.80	45
Total primary carbonatite	88.4	0.47	459
Total resources	**96.3**	**0.52**	**504**

Source: Cradle Resources *The JORC Code 2012 edition

Late 2014 drilling results could further increase confidence levels

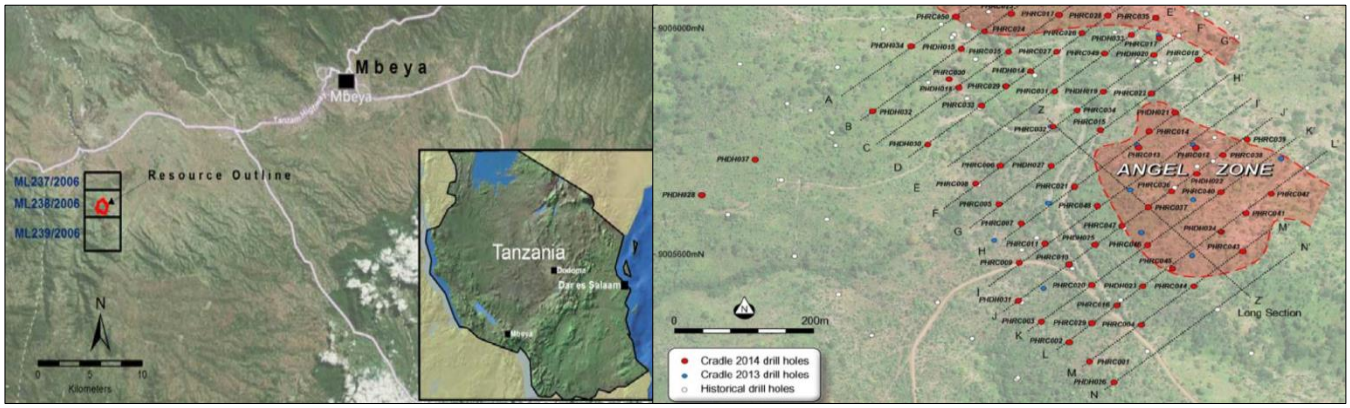
A further improvement in resource confidence will come following the Phase 2 in-fill drilling program, which commenced in early November, and was targeting the recently discovered higher-grade Angel Zone and the region directly to the north for measured resources (Phase 3 drilling campaign). This has been completed (results will be announced later in May 2015) and will form part of the DFS, since the Angel Zone will host the project's starter pit.

More to come…..

There is therefore scope for a further upgrade of resources to the indicated and measured category which could result in even better grade optimisation since the company will have a wider range of resources to access (PFS schedule is constrained to indicated resources during payback period) and should also lead to a maiden reserve declaration.

The deposit is still open at depth; while it has been sporadically drilled mainly towards the north and the west, only one third of the carbonatite outcrop has been tested.

Panda Hill's mining licences and resource drilling locations (2014 holes in red and 2013 holes in blue)



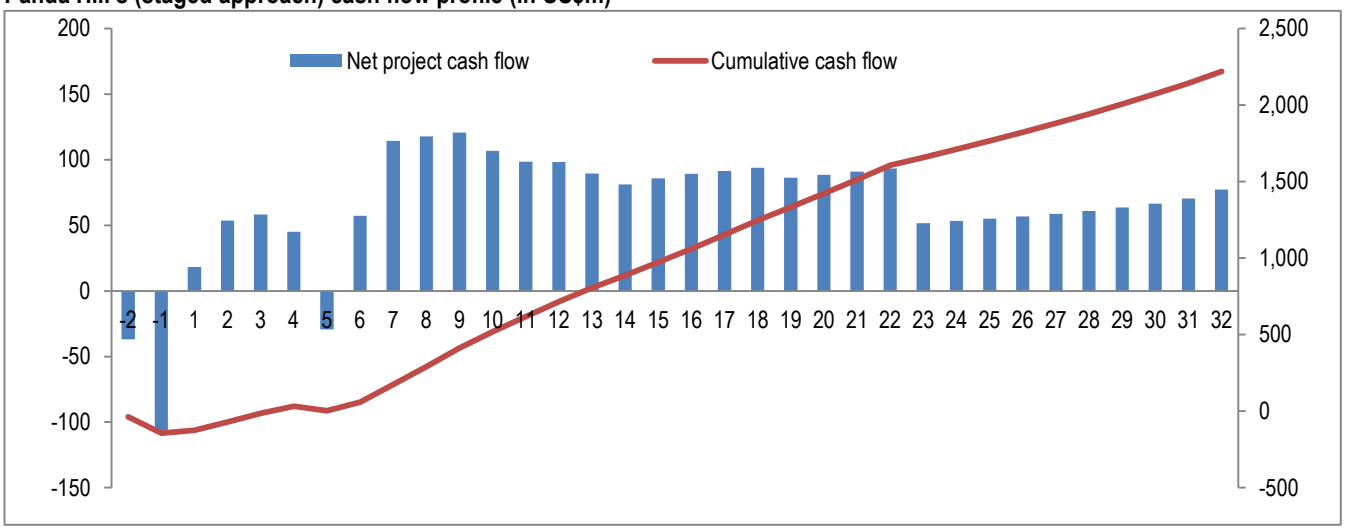
Source: Cradle Resources

Summary operating estimates (100% basis) – calendar years

CY to Dec. 31		2014A	2015F	2016F	2017F	2018F	2019F	2020F	2021F
Ore processed	kt	-	-	-	-	0.7	1.0	1.0	1.0
Recovery		-	-	-	-	57%	60%	61%	62%
Nb_2O_5 grade	%	-	-	-	-	0.71%	0.71%	0.71%	0.71%
FeNb produced (66% Nb garde)	kt	-	-	-	-	2.9	4.4	4.5	4.6
Nb price	US$/kg	-	40.00	41.00	42.03	43.08	44.15	45.26	46.39
On-site cash operating costs	US$/kg	-	-	-	-	24.2	20.6	20.2	20.0
Total cash costs	US$/kg	-	-	-	-	26.2	22.5	22.2	22.0

Source: Mirabaud Securities estimates

Panda Hill's (staged approach) cash flow profile (in US$m)



Source: Mirabaud Securities estimates

Summary financial estimates (unfunded, 50% Cradle-attributable basis) – financial years to 30 June

FY to Jun 30		2014A	2015F	2016F	2017F	2018F	2019F	2020F	2021F
Profit and loss									
Gross revenue	US$m	0.0	-	-	-	20.8	52.8	65.5	68.4
Operating costs	US$m	-	-	-	-	(13.3)	(30.6)	(34.7)	(35.0)
G&A	US$m	(1.5)	(1.5)	(1.5)	(1.6)	(1.6)	(1.7)	(1.7)	(1.7)
EBITDA	US$m	(1.5)	(1.5)	(1.5)	(1.6)	5.9	20.6	29.1	31.7
Depreciation & amortisation	US$m	-	-	-	-	(0.6)	(2.0)	(2.9)	(3.0)
EBIT	US$m	(1.5)	(1.5)	(1.5)	(1.6)	5.3	18.6	26.2	28.7
Interest	US$m	-	-	-	-	-	-	-	-
Tax	US$m	-	-	-	-	-	(0.2)	(4.9)	(4.7)
Net profit	US$m	(1.5)	(2.5)	(1.5)	(1.6)	5.3	18.4	21.3	23.9
Cash flow									
Cash-flow from operations	US$m	(1.5)	(2.5)	(1.5)	(1.6)	5.9	20.4	24.2	26.9
Cash-flow from investing activities	US$m	(2.4)	2.1	(9.2)	(35.7)	(29.5)	(4.3)	(2.7)	(2.7)
Cash-flow from financing activities	US$m	5.5	0.6	0.4	-	-	-	-	-
Net cash flow	US$m	1.6	0.2	(10.4)	(37.3)	(23.6)	16.1	21.5	24.2
Year-end cash balance	US$m	2.1	2.2	(8.2)	(45.5)	(69.0)	(53.0)	(31.5)	(7.2)
Ratios									
EV/EBITDA	x	n.a	n.a	n.a	n.a	3.1	0.9	0.6	0.6
PE	x	n.a	n.a	n.a	n.a	4.4	1.3	1.1	1.0

Source: Mirabaud Securities estimates, Cradle Resources A$1 = US$0.76

Appendix: the niobium market

Introduction

Niobium (Nb) is a lustrous grey, soft, rare, transition metal used in the production of high-grade steel. It is an alloying agent (usually with the form of FeNb), which when added to another material (steel) creates a final product (high-strength, low-alloy steel - HSLA) with substantial benefits (it is corrosion resistant, adds strength, reduces weight, improves flexibility and durability, and exhibits superconductivity properties).

Niobium faces strong competition from other refractory metals, particularly tungsten and tantalum (Nb chemical properties are very similar to those of tantalum), for applications in the dominant metal-oxide semiconductor (MOS) computer technology. Niobium, despite having a high melting point (2,468 ^{o}C), has a low density in comparison with other refractory metals. When very pure, it is comparatively soft and ductile.

Niobium is the 33rd most common element in the Earth's crust (20ppm on average), with a market (>US$2bn pa – 3 times the graphite market) with growth dynamics, mainly in anticipation of further increases in consumption BRICS and in particular from China. Niobium is found primarily in Brazil (~93%) and Canada (~7%), which account for about 99% of total reported niobium production (world reserves at 2.7Mt of contained niobium).

Uses of niobium

Niobium is used to enhance steel by adding strength while reducing weight, improving flexibility and increasing durability (anti-corrosive properties). These qualities make niobium-bearing steels desirable to the automobile-manufacturing industry and to constructors of large-scale, high-stress bearing structures (eg bridges, high-pressure oil and gas pipelines).

The main niobium marketed product is the standard grade (65-66% Nb) ferroniobium (FeNb), which is mainly used as an alloying agent in the production of HSLA, accounting for around 90% of total niobium consumption (HSLA accounts for ~85% of total Nb consumption).

Niobium producers by final product

Producer	% of Nb market	% of Nb market	Product	Applications	Principal Markets
CBMM Anglo American Niobec / Magris	76% 7% 7%	90%	Standard-grade FeNb (60-66% Nb)	HSLA* - 94% Stainless steel - 3% Heat-resistant steel - 3%	Auto industry - 25% Infrastructure - 45% Pipelines - 20%
CBMM	3.0%	3.0%	Vacuum grade FeNb (99% Nb)	Super alloys	Aircraft engines Power generation
CBMM	3.5%	3.5%	Nb metals and alloys (50-65% Nb)	Superconductors	Particle accelerators Small-tonnage uses
CBMM	3.5%	3.5%	Nb chemicals (>99% Nb)	Ceramics Catalysts	Optical Electronics

Source: Mirabaud Securities

*HSLA usually contains no more than 300ppm of Nb (300g of Nb/ tonne of crude steel or 450g of FeNb/tonne

Infrastructure - ~40% of total Nb consumption

Infrastructure (45% of world FeNb consumption or 40% of total Nb consumption):

- Millau Valley bridge (40Mt HSLA): 250ppm of Nb reduced weight by 60% (saving in steel and concrete)
- Oresund bridge (82Mt HSLA): 220ppm of Nb (total cost of Nb <US$1m)

resulted in cost savings of ~US$25m

- Commerzbank Tower (19.5Mt of steel incl. 10Mt of HSLA): 300-500ppm of Nb, resulted in a weight saving of 60Mt (vs. the reinforced concrete option).
- **The addition of 200ppm (0.02% or US$8/tonne) Nb to a tonne of steel can increase its strength by up to 30%**

Automotive industry - ~21% of total Nb consumption

Automotive industry (25% of world FeNb consumption or 21% of total Nb consumption):

- Nb enables significant cost benefits by improving fuel efficiency, reducing vehicle weight and environmental emissions as well as increasing passengers' safety.
- **US$12 of Nb (300gr)** added to a car (mid-sized car) will **reduce a vehicle's weight by 200kg**, which introduces a **5% fuel efficiency**
- 100kg weight reduction translates into a 6% reduction in CO_2 emissions (9g/kg). **EU legislation sets mandatory emission reduction targets for new cars (penalties may be as high as €95 for every g/km over the limit), from >150 g/km of CO_2 before 2010 to 130 g/km of CO_2 in 2015 to 95 g/km of CO_2 by 2020 (>35% CO_2 emissions reduction).**
- Between 2007 and 2015, the use of HSLA in cars in North America was forecast to grow from 11% to 40%. **This would double total world consumption of Nb.**

Oil & gas pipeline - ~18% of total Nb consumption

Pipelines (20% of world FeNb consumption or 18% of total Nb consumption):

- The main application for stronger and lighter steel (HSLA) pipes is to transfer natural gas over long distances under high pressure. As a result the increased consumption of natural gas will drive demand for HSLA steel.
- Natural gas transportation pipelines account for ~60-70% of total pipeline construction (the main use of HSLA steels).

The above result in a **cost effective** and **environmentally friendly (reduces carbon footprint)** metal with numerous known applications which are continuing to grow with potential end-users' increasing understanding of niobium's many beneficial properties.

Supply–Demand drivers

Supply – concentrate market

Niobium occurs in the mineral pyrochlore and columbite, which contain niobium and tantalum in varying proportions. The mineral pyrochlore (97% of Nb) is mined primarily for its niobium content. Columbite is mined primarily for tantalum with niobium extracted as a by-product.

Current producers vs. Cradle Resources

	CBMM	Anglo American (Catalao)	Magris (Niobec)	Cradle Resources (Panda Hill)
Country	Brazil	Brazil	Canada	Tanzania
Type	Open-pit	Open-pit	Underground	Open-pit
Resources (Mt)	1765	75	700	96
Resource Grade	2.0%	1.1%	0.4%	0.5%
LOM (years)	400	-	40	30
Capacity (FeNb kt)	120	7	8	6.5
Final Product	FeNb + Alloys +	FeNb	FeNb	FeNb
% of total production current (future)	88% (86%)	5% (6%)	6% (4%)	0% (4%)
Production Cost	US$10/kg Nb	US$18/kg Nb	US$23/kg Nb	US$19/kg Nb

Source: Mirabaud Securities

* Magris resources will decide if Niobec will be proceeding with the block-caving model for future expansion

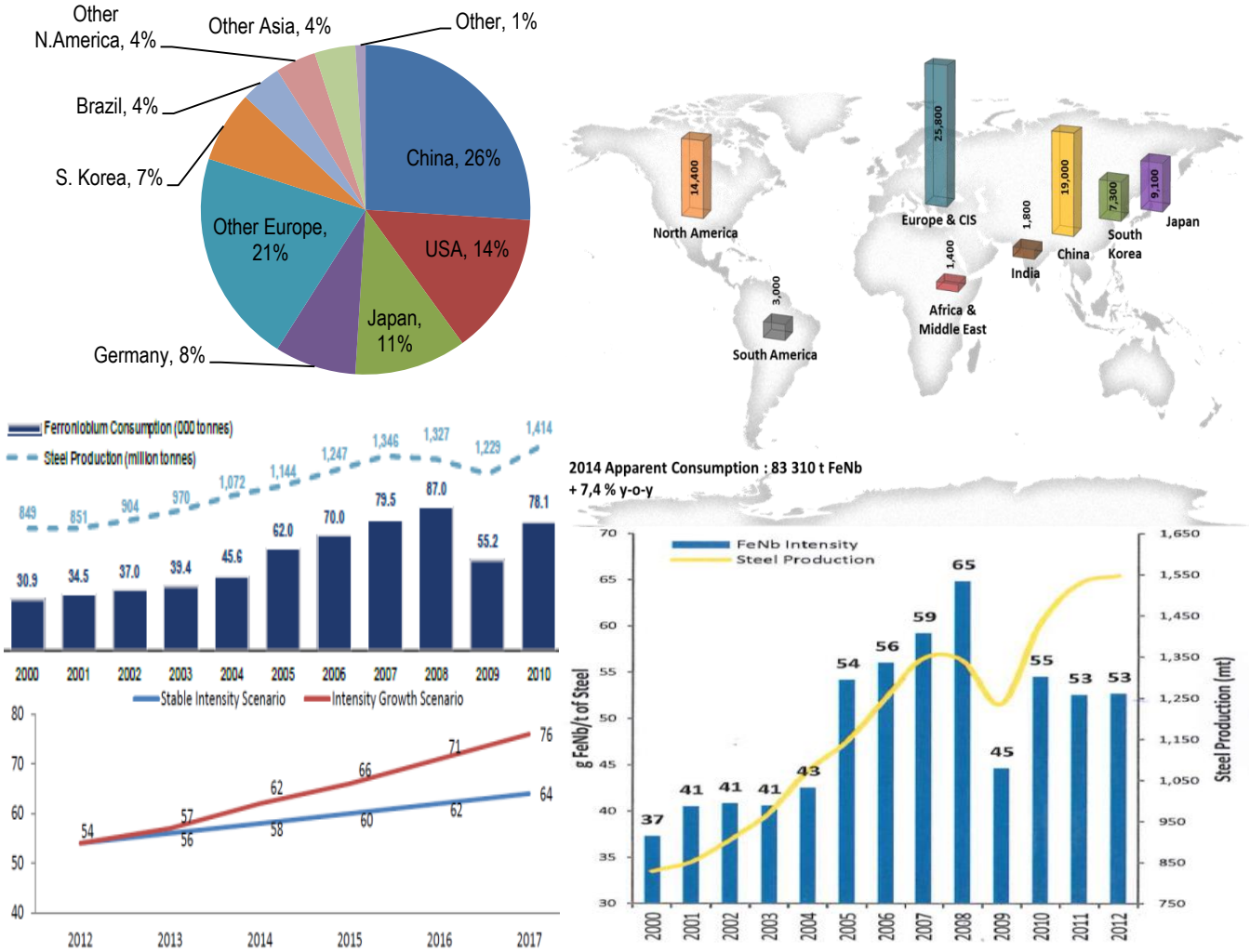
Almost 100% of current primary Nb production comes from three mines in the Americas (CBMM and Anglo American in Brazil and Niobec in Canada – see table below). All three producers convert pyrochlore concentrate to FeNb prior to sale, with CBMM being the only producer to offer a variety of other lesser-used niobium products (such as niobium metal, oxides and alloys).

Demand – twofold growth

The ferroniobium market is expected to grow in a twofold way; growth in steel production as well as growth in the niobium intensity used, which is estimated to exceed the increase in the output of steel.

With HSLA steel production the dominant end-use, **niobium demand** is closely correlated to global steel production. Rising steel demand over the past decade, mainly in the BRIC countries (particularly in China), has resulted in a compound annual growth rate in FeNb demand of over ~9% over the last ten years. We expect solid growth in steel production to continue, albeit perhaps at a slower rate compared with the past decade, and FeNb demand, which is currently 80-100ktpa, may outpace this growth if the trend established over the past decade is maintained (see chart below).

Annual FeNb consumption (by country) and intensity of FeNb use in steel (five-year forecast)



Source: Iamgold (compiled using data provided by Roskill and World Steel Association), Mirabaud Securities

One reason for this historical outperformance relative to steel production growth is the **intensity of niobium's use in steelmaking** – as customer requirements for higher-spec steels increase, so steelmakers must increase the amount of niobium used to produce steel capable of meeting these higher standards. According to Niobec, the average FeNb content of steels was approximately 40g/t in 2000. Across the next eight years this figure rose by over 60%, to 65g/t. Average global FeNb intensity levels in steelmaking fell sharply in 2008 in the wake of the global credit crisis, but quickly rebounded and have remained in the 50-60g/t range over recent years, but with a large degree of geographic variation – **intensity levels in the US (>100g/t), EU and Japan (~80g/t) are higher, but in the majority of the emerging-market economies (China ~30g/t) they are significantly below the global average (~55g/t).**

Given that niobium represents a very small percentage of the total cost of producing steel (<0.5%), yet adds significant value to those steels by virtue of its strength, weight and durability characteristics, we would expect intensity of use to continue to rise (by a minimum of 15% within the next four years - see graph above). In particular the emerging economies, which account for ~35% of current world's consumption (China, India, Russia and Turkey), will see incremental growth in intensity (doubled by 2017).

China, the world's largest steel producer (with its share of world production rising from 1% in early 1990s to ~40% today), is the biggest HSLA steel producer (and thus FeNb consumer – see graph above) and we expect to see increased steel production (HSLA steel currently accounts for just 10% of all steels produced, compared with around 20% in the developed world) as well as quality of its steel production with an increase in intensity of niobium's use.

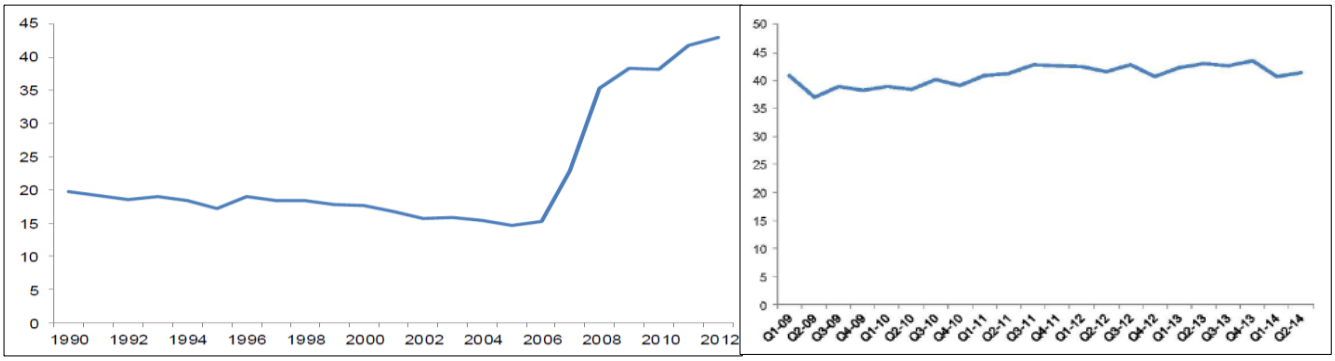
FeNb pricing – not demand-driven

Almost 95% of FeNb production is sold under long-term contracts between producers and consumers, with only 5% being sold via the spot market. Although contract prices are not disclosed, trends can be seen from average import values.

FeNb prices are not demand-driven but are largely determined by CBMM, as a result of both its dominant position in the market as well as due to the apparent willingness of its two competitors to let CBMM lead. On top of that, the significant technical advantages offered by the use of Nb (see p11), combined with the fact that FeNb constitutes a very small proportion of the overall cost of producing a niobium-bearing steel (typically less than 0.5%), means that demand is relatively inelastic to price. These are are also contributing factors to CBMM's ability to influence prices.

Clearly, given its position as the overwhelmingly dominant producer, and ability to expand production significantly over the medium to long term, CBMM has the ability to discourage any prospective new supply by dropping its prices. However, we believe this is a highly unlikely scenario, as the required price drop would be substantial and would therefore have a significantly detrimental impact on the group's own profitability. Even in that case, Panda Hill would remain economically viable producing at a lower cost compared with both Niobec (underground mine) and Catalao.

Historic (and 5-year) niobium price (US$/kg Nb, nominal prices)



Source: Roskill, Iamgold

The recent (2006-08) increase in Nb prices (after a lengthy period of stability), was mainly a result of CBMM's marketing efforts (mid-2000s) which succeeded to more than double Nb prices to current levels (five-year average of ~US$40/kg Nb).

The relatively steep price increase between 2006 and 2008 (see graph above), with a simultaneously increase in production, indicates a demand-inelastic price environment as well as that the market was ready to accept a price increase. We believe FeNb prices will continue to rise gradually in the medium to long-term, without being massively impacted by extra production added from potential new producers, given the absence of undeveloped projects with the scale to match CBMM. Instead, we see as more likely one more increase in prices when CBMM will consider that the product may be undervalued.

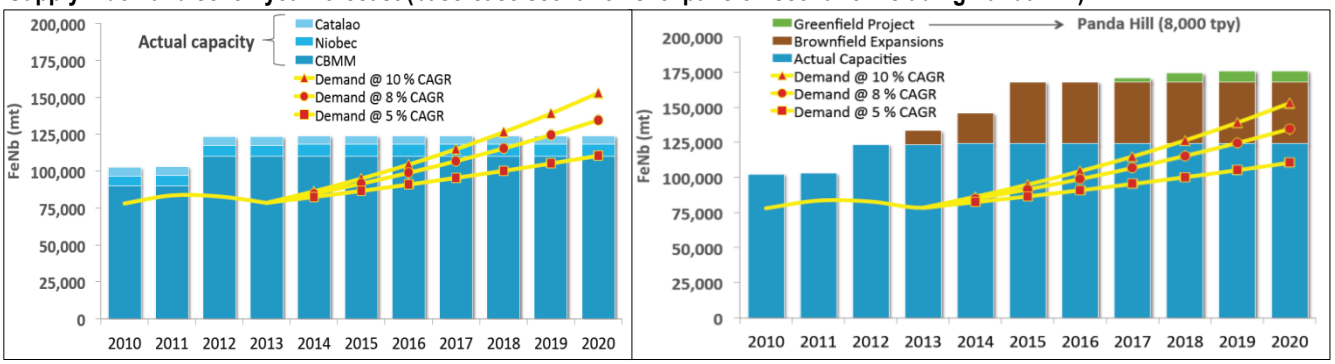
World forecast FeNb and Nb capacity, production, cash cost

	Resources (Mt)	Reserves (Mt)	Grade (Nb_2O_5 %)	Capacity (kg of FeNb)	Nb production (kg of Nb)	Cash cost US$/kg Nb	Market share
			Current – status				
CBMM	1765	440	2.0%	120,000	79,200	10	89.6%
Catalao	75	4	1.2%	6,700	4,158	18	4.8%
Niobec*	698	416	0.4%	7,900	5,214	23	5.6%
Total	***1913***	***860***	***1.4%***	***134,600***	***88,572***	***11***	***100.0%***
			Expansion				Date
CBMM				30,000	19,800		2016
Catalao				3,300	2,310		2017
			Total Capacity				
CBMM				150,000	99,000	10	85.9%
Catalao				10,000	6,468	18	5.6%
Niobec*				7,900	5,214	23	4.4%
Panda Hill	***96***	***-***	***0.5%***	***6,500***	***4,528***	***19***	***4.0%***
Grand Total				**174,400**	**115,210**	**11**	**100%**

Source: Roskill, Iamgold, Mirabaud Securities

*Niobec's expansion not included due to uncertainty

Supply – demand seven-year forecast (base-case scenario vs. expansion scenario including Panda Hill)



Source: CAMET, Cradle Resources

Niobium: a semiprecious metal

Niobium, assuming an average long-term price of US$40/kg, is ~3x and ~7x more valuable than nickel and copper respectively (based on our own long-term metals price assumption of US$40/kg), while it is only ~13x less valuable compared with silver. According to the table below, Nb in terms of value, is ranked between precious and base metals.

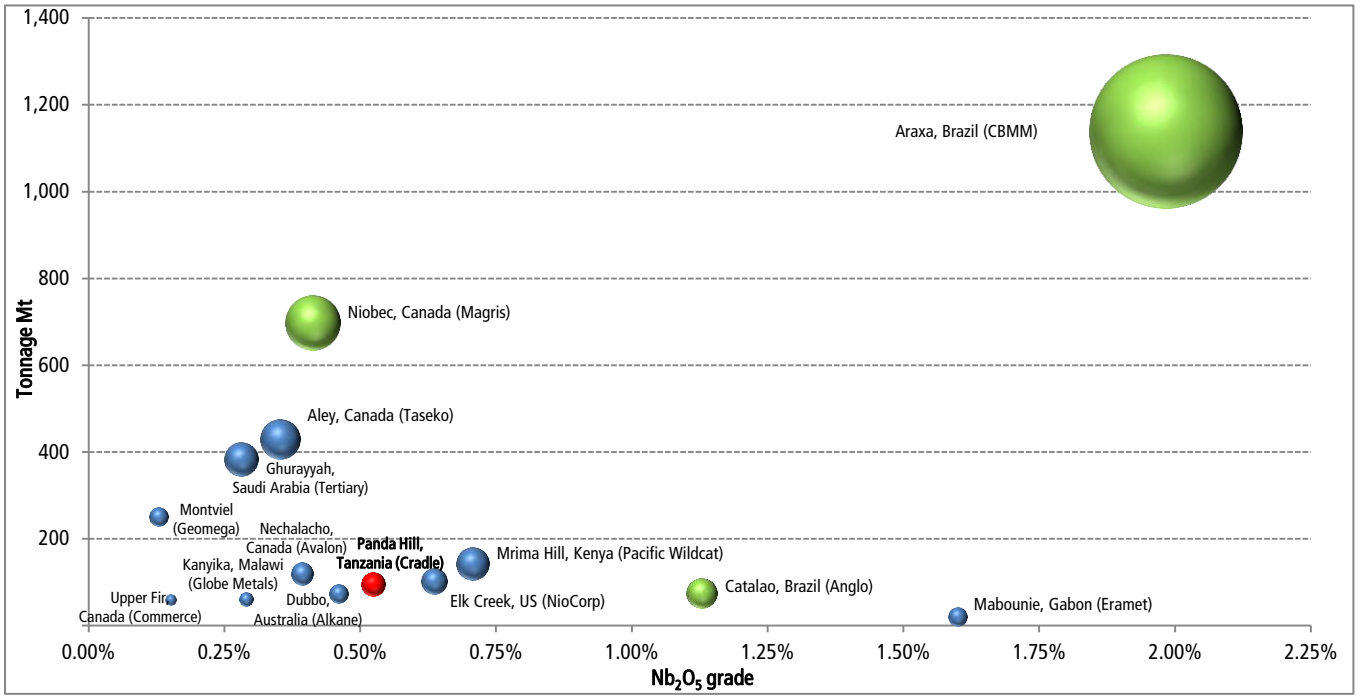
Cradle's niobium project (Panda Hill) has the same value as an equivalent open-pittable gold deposit with grade 2.3g/t and size of 7.4Moz. The quality of the Panda Hill deposit is easier to understand when compared with equivalent deposits of other metals (tabulated below).

Niobium (and Panda Hill project) vs. other metals

				US$/kg	Metal/Nb (times)	Grade (eq.)	Metal (eq.)
Precious Metals	Pl	US$/oz	1400	43546	1089	2.3 g/t	6.4Moz
	Au	US$/oz	1200	37325	933	2.3 g/t	7.4Moz
	Ag	US$/oz	17	529	13	2.3 g/t	524Moz
Base Metals	Ni	US$/t	15000	15	0.38	0.23%	593 Mt
	Cu	US$/t	6000	6	0.15	0.23%	1,483 Mt
	Zn	US$/t	2000	2	0.05	0.23%	4,450 Mt
	Al	US$/t	2000	2	0.05	0.23%	4,450 Mt
	Pb	US$/t	2000	2	0.05	0.23%	4,450 Mt
Minor Metals	Mg	US$/t	2000	2	0.05	0.23%	4,450 Mt
	Mo*	US$/t	25000	25	0.63	0.23%	356 Mt
	Nb	**US$/kg**	**40**	**40**	**-**	**0.23%**	**223 Mt**

Source: Mirabaud Securities

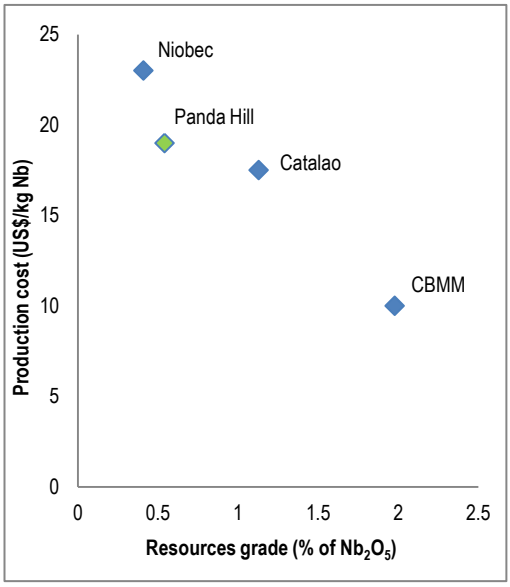
The world's major niobium resources



Source: Mirabaud Securities estimates, Cradle Resources

Why Panda Hill?

In such a concentrated market, for a project to become economically viable and remain unaffected by price variations as well as by its competitors, it should have a number of key characteristics (open-pittable with low strip ratio, high grade, simple metallurgy and relatively low operating costs). Panda Hill has these characteristics.



A number of other niobium deposits are also known but remain undeveloped, in most cases owing to permitting obstacles or reliance on by product minerals (such as rare earth elements) for economic viability. On top of its very favourable deposit characteristics, Panda Hill is located in a mining friendly country – Tanzania - and is well-served by excellent local infrastructure (paved highway, rail and close to an international airport).

Of the main undeveloped resources (see chart above), only Panda Hill, Aley and Elk Creek can be considered true primary niobium projects, with Aley having difficult metallurgy and significantly lower grade than the established producers and Elk Creek lying at substantial depth below surface. With respect to the other projects, niobium occurs with a suite of other minerals (eg tantalum, zirconium and rare earth elements), which can present processing challenges and may also mean development prospects are tied to the economic viability of those other commodities. As a result we do not foresee a new entrant from a primary Nb producer, particularly not one with a project of better quality, in the foreseeable future.

Panda Hill valuation based on recent sector deals

The niobium market, despite its oligopolistic features, has been very active recently, with three deals taking place in the last four years. In 2011 (March and September) CBMM sold a 15% of the company to a Japanese and Korean steel consortium for US$1.95bn and another 15% stake to a Chinese consortium for US$1.98bn, while in late-2014 Iamgold sold its 100% owned Niobec mine to Magris Resources (a PE group) for a total consideration of US$530m (comprising US$500m in cash and US$30m in royalties).

Panda Hill, due to its relatively high-grade, open-pittable, simple-metallurgy deposit which allows for low operating costs, is rated above the Niobec mine. We estimate that Panda Hill, when in production, will be ranked as the second cheapest niobium producer, behind only the big CBMM, with a relatively long life-of-mine of more than 30 years.

In an attempt to value Cradle on an EV multiple basis we are applying to the company a number of EV multiples based on the above mentioned deals. We expect higher-quality deposits to trade at higher multiples; therefore we assume that Panda Hill, which in our view should be ranked between Niobec and CBMM, to trade at a 90:10 weighting of the other two projects, implying an EV of ~US$75/kg of niobium production (~US$113/kg of FeNb). The latter values Cradle (50% of Panda Hill) at US$244m (~30% higher compared with our discounted model cash flow valuation of ~US$185m)

Cradle project-based valuation

	Deal size ($m)	% of the company	Implied equity valuation ($m)	Production kt of FeNb	EV/tonne production (t of FeNb)	Multiple (x)	EV/t attr. to Cradle	Cradle's valuation
CBMM	3,930	30%	13,100	120.0	109	10%	11	
Niobec	530	100%	530	7.5	71	90%	64	
Panda Hill		50%		6.5			75	244

Source: Mirabaud Securities

RECOMMENDATIONS HISTORY

Cradle Resources Ltd

Market index FTSE AIM Basic Resources

Date	Market Index	Stock Price (A$)	Valuation (A$)	Opinion
02 July 2014	2,683	0.19	0.50	SPECULATIVE BUY
04 February 2015	1,860	0.15	0.55	SPECULATIVE BUY
31 March 2015	1,902	0.22	0.56	SPECULATIVE BUY

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BUY: The stock is expected to generate absolute positive price performance of over 20% during the next 12 months.

ACCUMULATE/OVERWEIGHT: The stock is expected to generate absolute positive price performance of 10-20% during the next 12 months

NEUTRAL: The stock is expected to generate absolute price performance of between 10% positive and 10% negative during the next 12 months.

REDUCE/UNDERWEIGHT: The stock is expected to generate absolute negative price performance of 10-20% during the next 12 months

SELL: The stock is expected to generate absolute negative price performance of over 20% during the next 12 months.

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Cradle Resources Ltd (CXX AU): 2, 3 and 8

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