EQUITY RESEARCH






Erin Ventures

Boron for Europe

MMG CAPITAL
Metals & Mining Global Capital

By **Nick Hatch**

Non-Independent Research

30 June 2022

Market Data: note priced 30 June 2022

Stock Code	TSXV: EV
Price (C$)	0.085
12 m High (C$)	0.15
12 m Low (C$)	0.045
Shares (M)	153.87
Mkt Cap (C$M)	13.1
Free Float	100%

Description

Erin Ventures has just completed (June 2022) a new Preliminary Economic Assessment (PEA) on its Piskanja boron project in Serbia, and hopes to apply for a mining licence in H1 2023. The deposit contains a total mineral resource of 7.2Mt grading 34.6% B_2O_3 (the highest grade of any known development project) and containing 2.5Mt B_2O_3.The PEA indicates initial capex of US$80M, a post-tax NPV (10%) of US$525M and IRR of 79%, and a 12-month payback, with annual production of 258,272t of colemanite and 25,0000t of boric acid.

Company information

President & Director	Tim Daniels
CFO & General Manager	Blake Fallis
Director & Manager of Mining Operations	Jim Wallis
Director	Dusan Podunavec

www.erinventures.com

Source:Yahoo Finance. Figures in C$

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PEA shows sound economics

Erin has just released an updated Preliminary Economic Assessment on its Piskanja boron project in Serbia, with a post-tax NPV (10%) of US$525M, an IRR of 79% and a 12-month payback period. Even after assuming that Temas Resources fulfills the terms of the joint venture agreement and acquires a 50% stake in the project, and discounting the project valuation by 50% for development (country and project) risk, based on the PEA we value Erin at C$122.3M or C$0.79/share vs a current market capitalisation of C$13.1M and share price of C$0.085.

- **New PEA with excellent economics.** In June 2022 a new PEA on Piskanja was completed which highlights a 16-year mine life and annual production of 258,272t of colemanite (the key borate mineral at the mine) and 25,000tpa boric acid. This is based on a mineral resource of 7.2Mt grading 34.6% B_2O_3, which is a higher grade than for any other known development project. With capital expenditure of US$80M (inclusive of a 30% contingency), the mine yields a post-tax NPV of US$525M (at the base case discount rate of 10%), an IRR of 79% and a payback of initial capex of 12 months. These are superior economics relative to any peer project.
- **Boron – a commodity with decarbonisation potential.** Boron is a little understood commodity, but has widespread applications. Traditional applications are in insulation, specialty glass, fibreglass, porcelain ceramics and fertiliser. The market has championed a number of commodities for their "green" potential including lithium, Rare Earths and graphite. But boron is also used in EV motor magnets, wind turbines, solar panels, and in new and experimental technologies for fuel cells, energy storage and radiationless hydrogen-boron fission (nuclear power). Boron markets are broadly balanced at present, but Credit Suisse estimates that demand could increase 4X to 10X current levels by 2050, and new projects will need to be developed to meet this demand.
- **Serbia.** Mining in the country is primarily focused on copper-gold, but there are a number of lithium-boron projects in the country, the most notable of which is Rio Tinto's Jadar project. There have been growing environmental protests which led to the revoking of Rio's licences before the April 2022 elections in Serbia, but we expect a compromise to be reached, and note that Piskanja is unlikely to suffer from the same issues – it will be a small underground mine with waste backfilled underground, using the surface facilities of a state-owned coal mine which is in the throes of closing down.

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Cover photos, from top left, clockwise : Serbian colemanite borate mineral specimen; key boron uses in LCD screens, wind turbines, porcelain enamel, smart phones, ferilisers, solar panels and insulation

Investment Case

- **Boron – little understood, but key to Net Zero carbon emissions** – Boron has one of the widest ranges of end-use applications of all commodities. Traditional end-use applications are in insulation, frit-glazed ceramics, fertilisers, specialist glass and fibreglass, and LCDs. However, as an industrial mineral rather than a metal, boron is not at the forefront of investors minds when they think of the push for decarbonisation and the ambition of achieving Net Zero carbon. Most investors are familiar with the use of lithium, Rare Earths and graphite in EVs and wind turbines etc, but boron also plays a key role in wind turbines, permanent magnets for EV motors, solar panels, energy storage, fuel cells, building insulation and a myriad of other applications. Research is ongoing into new and exciting technologies, such as radiationless nuclear energy from hydrogen-boron fusion. According to Credit Suisse, demand could grow 4-10X by 2050, and while the market is essentially balanced now, new mining capacity to meet this growth in demand is limited. Currently global supply is dominated by state-owned Eti Maden in Turkey, and by Rio Tinto in California. European industry gets almost all of its boron from Turkey, and is keen on seeing alternative local sources of material. While there are other mainly lithium-boron deposits that may be developed (primarily in the USA and Serbia), Erin's Piskanja project in Serbia is the most advanced pure boron project and, as a single-asset company, Erin Ventures is the best pure-play for investors who wish to benefit from boron's growing green credentials.
- **New PEA on Piskanja** – In July 2021, Erin completed a joint venture agreement with Temas Resources whereby Temas will earn a 50% interest in Piskanja (with Erin retaining 50%) in return for expenditure of €10.5M on the project and 250,000 Temas shares and warrants. Erin has just released (June 2022) details from a new Preliminary Economic Assessment (PEA) on the Piskanja project in Serbia. The deposit contains a total mineral resource of 7.2Mt grading 34.6% B_2O_3; Piskanja is one of the highest grade boron deposits in the world. The PEA yields a post-tax NPV (at a 10% base case discount rate) of US$524.9M, a post-tax IRR of 78.7% and a 12-month initial capital expenditure payback from start-up. These are better economics than any peer group project. Initial capital costs for the 16-year mine life are estimated at US$79.9M (including a 30% contingency) and the mine is expected to produce an average of 258,272tpa of sales grade colemanite (the key boron mineral at Piskanja) and 25,000tpa of boric acid. The company hopes to complete a feasibility study and apply for a mining licence in H1 2023. We believe that mining could start as early as 2026.
- **Mining in Serbia** – Mining in Serbia is limited, with the key focus being the copper-gold mining and smelting industry around Bor in the Timok Magmatic Complex, which has been in production for over 100 years. Environmental concerns have been growing here, and at various exploration projects, in particular Rio Tinto's large Jadar lithium-boron project. These issues were exacerbated in the run-up to the April 2022 parliamentary and presidential elections and resulted in Rio Tinto's licences being revoked. With the Serbian Progressive Party retaining parliamentary and presidential control, we suspect that a comprise with Rio Tinto will be reached. In any event, Erin is unlikely to suffer from the same issues. Piskanja will be a small underground mine with waste rock backfilled underground. The mine will use surface facilities on an existing brownfields site, a state-owned coal mine that is being decommissioned. The mine will create employment for the former coalminers, and we understand that the majority of the local community supports the development of Piskanja.
- **Valuing Erin Ventures** - There are only a limited number of peers to compare Piskanja and Erin against. The two most obvious peers are 5E Advanced Materials and Ioneer, both of which have lithium-boron projects in the USA, have completed feasibility studies, and are nearing a development decision. While Piskanja is at a less advanced PEA stage and is a smaller project, it has a higher IRR and shorter payback period than its peers, and is best located to wean Europe off its near-exclusive dependence on boron supply from Turkey. We have valued Erin's share of Piskanja by taking the June 2022 PEA valuation of Piskanja (US$525M) and assumed a 50% chance of development (to take into account country and project risk). We have then adjusted for the sale of 50% of the project to Temas, the €10.5M capital cost commitment from Temas and then assumed that Erin is responsble for 50% of the remaining capital cost. We have also adjusted for net cash and cash equivalents, and 3 years of ongoing operating and exploration costs. The result is a value of C$122.3M for Erin Ventures which is significantly higher than the current market capitalisation of the company, at C$13.1M. On a per share basis, our valuation equates to C$0.79/share compared with the current share price of C$0.085, implying the potential for a significant revaluation of the shares.

Erin Ventures: a snapshot

About Erin

Erin is headquartered in Canada, and listed on the TSXV. Its key exploration asset is the Piskanja boron deposit in Serbia, where it was first granted an exploration licence in August 2010 that has subsequently been extended. A mineral resource was published in 2016 and subsequently amended in February 2019. A Preliminary Economic Assessment (PEA) was published in September 2014, and Erin has just completed (June 2022) a new PEA. Erin plans to apply for a mining licence before September 2023, when the exploration licence expires. In July 2021 Erin completed a joint venture deal with Temas Resources, whereby Temas can earn a 50% stake in Piskanja in return for expenditure of €10.5M on the property and 250,000 Temas shares and 250,000 share purchase warrants. As at 31st March 2021 Erin had a net cash equivalent position of c. C$92,500.

What is the Piskanja boron project?

Piskanja is located in south-central Serbia, 17km from the border with Kosovo, and covers 306ha. It is the only pure boron project in Serbia, although there are a number of lithium-boron deposits in the country, of which Rio Tinto's Jadar project is the best known. Geologically, the lithium-boron deposits of Serbia are in the Vardar Zone tectonic belt, which includes the world's largest boron producer, Turkey's state-owned Eti Maden. Turkey produces 62% of the world's boron and has 73% of the world's reserves. The most recent total mineral resource estimate at Piskanja (June 2022) is 7.2Mt grading 34.6% B_2O_3, which makes the project one of the highest grade boron deposits in the world. The key boron mineral is colemanite. The recent June 2022 PEA yields a post-tax NPV (at the 10% base case discount rate) of US$524.9M, a post-tax IRR of 78.7% and a 12-month capex payback from start-up (better economics than any peer group project). Initial capital costs for the 16-year mine life are estimated at US$79.9M (including a 30% contingency) and the mine is expected to produce an average of 258,272tpa of sales grade colemanite and 25,000tpa of boric acid. We believe that mining could start as early as 2026.

What is boron and what are its uses?

As an industrial mineral rather than a metal, with few ways to invest in it on the world's stock markets, borates (boron minerals) are little understood by investors. Yet the commodity has one of the widest ranges of applications. Key traditional uses are in insulation, frit-glazed ceramics, fertiliser, specialised glass, fibreglass and LCDs. But boron has a number of applications in new cutting-edge technologies, and is on the EU's critical materials list. New Age applications include its use in the magnets for EV motors and wind turbines, and in solar panels. Research is ongoing into radiationless hydrogen-boron fusion nuclear energy, fuel cells and energy storage. Decarbonisation is expected to result in supply shortfalls – Credit Suisse forecasts that boron demand could grow by 4-10X by 2050. The supply issue is compounded by the geographical concentration of supply due to, typically, the need for unique conditions – Cenozoic Era volcanism, thermal spring activity, closed basins and an arid climate. Turkey and California have had a combined global market share of 70-85% for decades, and almost all of Europe's boron comes from Turkey. European boron-consuming industries would welcome a new source of regional supply.

Challenges in Serbia?

In the run-up to the recent April 2022 election, a number of mining companies operating in Serbia experienced environmental challenges from NGOs and local stakeholders, none more so than Rio Tinto's Jadar lithium-boron project. Given the economic significance of Jadar, we anticipate that Rio Tinto will eventually manage to negotiate a suitable compromise with Serbia's government and local stakeholders, but the issue has clearly impacted sentiment towards the mining industry in Serbia. However, Erin has cited strong local support for its project and notes that the mine has a small surface footprint (c.5ha only) and mining will be by underground methods, with waste material reintroduced to the mine for disposal. The region has a strong mining culture – coal has been mined in the area for over 100 years, but these operations are currently being decommissioned. Erin expects to employ c.200 people, many of whom are likely to come from the local coal mine as it closes. The Piskanja project is on land already zoned for industrial use by the closing government-owned coal mine.

The borate industry

An introduction

What are borates?

The term borates refers to a family of naturally-occurring minerals that contain the element boron (B). There are c.280 known borate minerals, of which 11 are currently commercially significant, and a twelfth, jadarite, is also commercially viable. These commercial minerals are all oxides/hydroxides and sodium and calcium minerals make up over 90% of the market. The four most commonly extracted minerals are colemanite, ulexite, tincal and kernite.

Figure 1: Economically significant borate minerals

Mineral	Formula	Boric Oxide wt.%
Kernite	$Na_2B_4O_7.4H_2O$	51.0
Borax (tincal)	$Na_2B_4O_7.10H_2O$	36.5
Ulexite	$NaCaB5O_9.8H_2O$	43.0
Colemanite	$Ca_2B_6O_{11}.5H_2O$	50.8
Boracite	$Mg_3B_7O_{13}Cl$	62.2
Sassolite	H_3BO_3	56.3
Datolite	$CaBSiO_4(OH)$	24.9
Probertite	$NaCaB_3O_9.5H_2O$	49.6
Szaibelyite	$MgBO_2(OH)$	41.4
Tincalconite	$Na_5[B_4O_5(OH)_4]_3.8H_2O$	47.8
Priceite	$CaBO_{19}.7H_2O$	49.8
Jadarite	$LiNaSiB_3O_7(OH)$	47.1

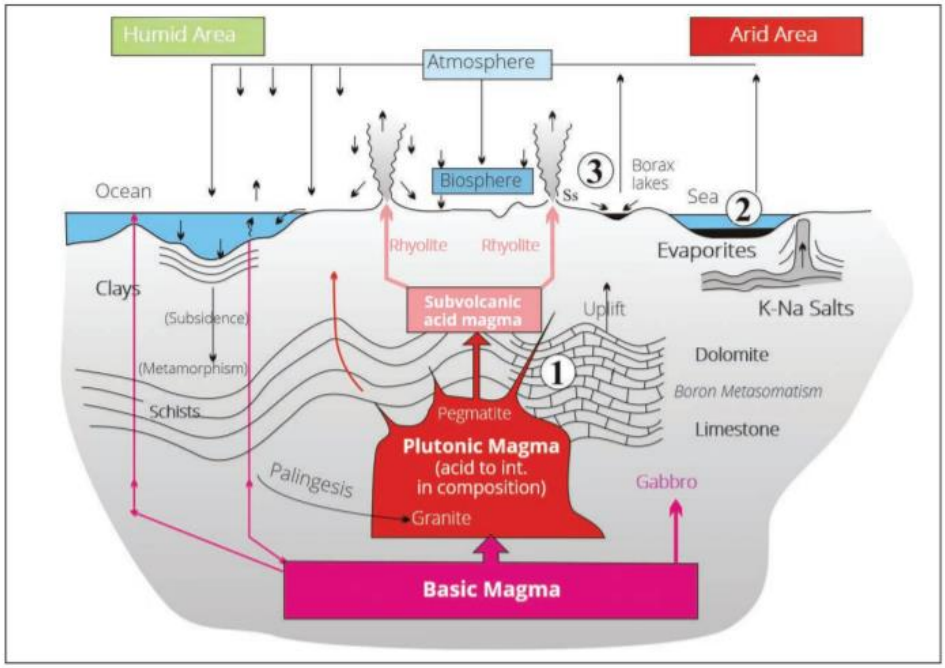
Source: mininggeologygroup.com, Rio Tinto, webminerals.com

Borates are relatively rare minerals, and although borates resources are abundant, relative to demand world-class economic deposits are geographically and geologically concentrated. Industrial minerals' markets tend to be opaque, and this is truer for borates than for many others. This is in part a function of supply dominance in western markets by Eti Maden, Turkey's state-owned producer, and Rio Tinto, together with a modest number of smaller private producers. Thanks to commercial sensitivities, reserves, resources and production/supply data are therefore difficult to find, as is demand data. Borates satisfy a wide range of industrial applications, primarily in glass, ceramics and agriculture, and in some cases producers meet their customers' demands by supplying bespoke, uniquely engineered raw materials for specific applications – compounding the issue of acquiring reliable demand data. Borate prices are not readily available, and given that producers may supply mineral ores, concentrates, acids, and higher value specialty and advanced materials, this adds to the opaque nature of the market.

The geology and geography of borate supply

The majority of borate deposits – and in particular those of Turkey, which dominates global supply – are related to geologically young Cenozoic Era volcanism, thermal spring activity, closed basins and an arid climate. These playa-lake sedimentary deposits, linked with explosive volcanic activity, are dominated by sodium and calcium boron hydrates. There are two other, much less significant, geological environments – skarn deposits associated with silicates and iron oxides, and marine evaporitic sediments, dominated by magnesium boron oxides.

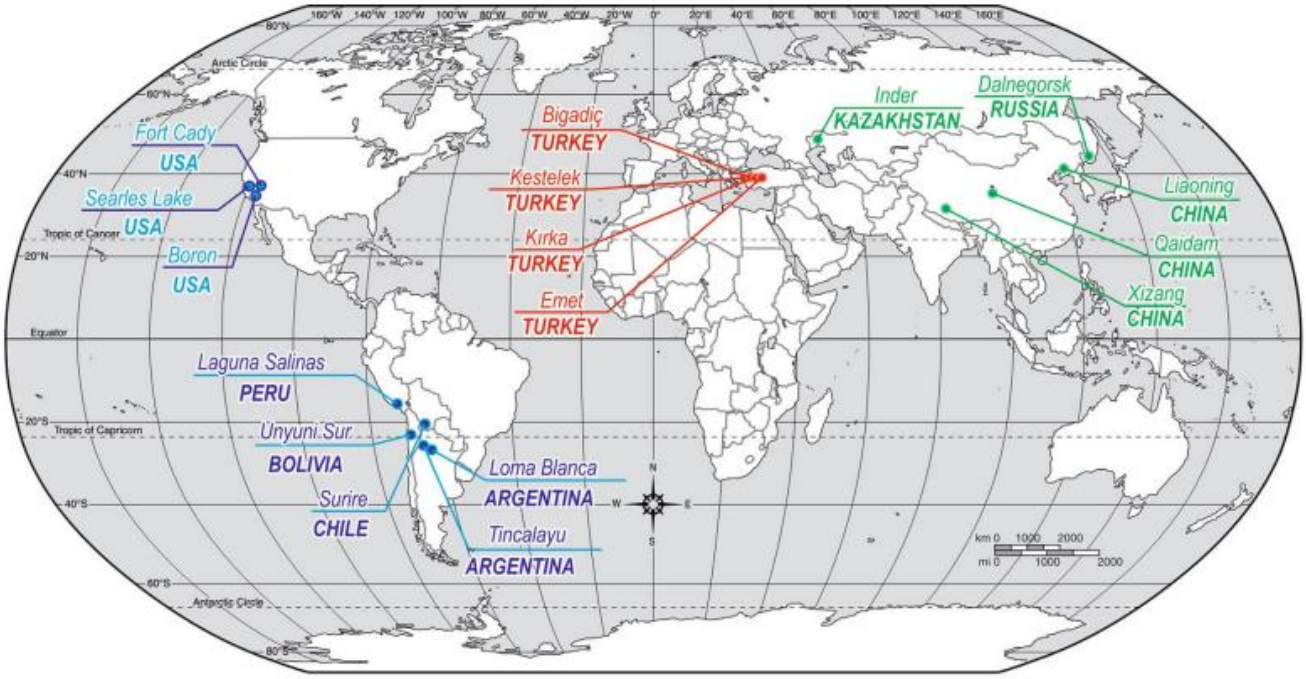
Figure 2: Borate ore deposit setting



Source:C. Helvaci, Bull.Min.Res.Exp.(2015) 151: 169-215. (1) Skarn deposits; (2) Marine deposits; (3) Playa-lake deposits

The four key criteria – Cenozoic volcanism, thermal springs, closed basins and arid climate – have ensured that economic borate deposits are concentrated in four key metallogenic borate provinces – Anatolia (Turkey), California (USA), Central Andes (South America) and Tibet (Central Asia).

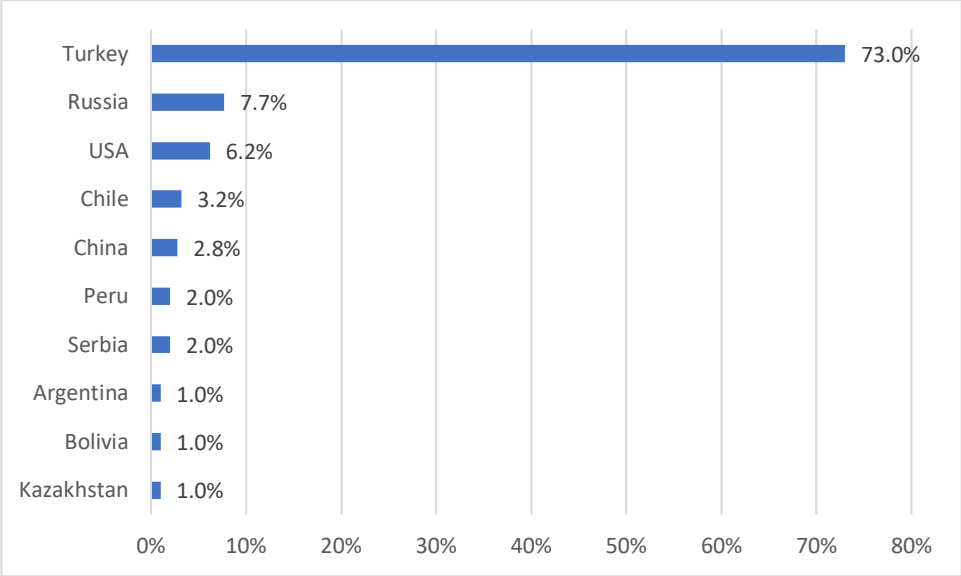
Figure 3: Geographical distribution of the world's major borate mines



Source: Helvacı C and Palmer MR (2017) Origin and distribution of evaporite borates: the primary economic sources of boron. Elements 13, 249–254

The geographical concentration is even more focused when one considers the concentration of reserves and production. According to Eti Maden, the Turkish state-owned producer, its current global market share (source: Eti Maden 2019 annual report, its latest published report) is 73% of global borate reserves, and production of 1.89Mt of concentrated boron products and 2.04Mt of refined boron products (sales of 2.06Mt). Eti Maden claims global boron consumption in 2019 was 3.71Mt, giving it a 56% global market share. Rio Tinto produced 520,000t (or 14% of the global total) in 2019 and 488,000t of borates (B_2O_3 content) in 2021. The market is therefore in effect a duopoly of Eti Maden and Rio Tinto, and these two companies have had a combined global market share of 70-85% for many decades. Turkey's supply dominance is also clear from the reserve picture; Eti Maden claims that the country possesses 73% of the world's commercial boron reserves, while no other country exceeds 8%. The duopoly of supply of boron minerals is further compounded by the fact that China dominates the supply of boron specialty and advanced materials - 80% of boron carbides, for instance, come from China.

Figure 4: Turkey dominates the geographical concentration of commercial boron reserves



Source: Eti Maden

Investment options

For potential investors in boron, there is little choice (we shall review Erin's peers later in this note; this is a brief summary). Rio Tinto has reserves of 14Mt of borates in the US (in California's Mojave Desert). At Jadar in Serbia, Rio Tinto has additional resources of 14Mt. However, Rio's borates business contributed a net profit of just US$32M in 2021 out of a group total of US$21,380M ie just 0.015% of the total, so this is no way to get exposure to the boron market. Stock market exposure elsewhere in limited.

5E Advanced Materials (recently renamed from American Pacific Borates) recently moved its primary listing from the ASX (Australia) to NASDAQ (USA), though a secondary listing will be maintained in Australia. The company's Fort Cady project also lies in California's Mojave Desert and contains a JORC resource of 120.44Mt grading 6.51% B_2O_3, 11.57% H_3BO_3 and 344 ppm Li, equating to 7.84Mt of B_2O_3 and 13.93Mt H_3BO_3. The company hopes to start production this year at a run-rate of +400,000tpa (boric acid equivalent). Geologically, the lacustrine sedimentary rocks that host boron frequently host lithium too, and it is possible that other lithium explorers/developers may be able to develop by-product boron streams in the future.

In Nevada, Ioneer (listed in Australia, but also considering a NASDAQ listing) operates the Rhyolite Ridge lithium-boron project. This has a JORC resource of 146.5Mt grading 8.1% H_3BO_3 and 0.9% Li_2CO_3 and containing 11.89Mt H_3BO_3 and 1.25Mt Li_2CO_3. Production of 174,000tpa B and 22,000tpa Li is mooted, though a final investment decision has yet to be taken.

Also listed in Australia, as well as Toronto, is Allkem (formerly Orocobre), which merged with Galaxy Resources in 2021 and has c.40,000tpa of Lithium Carbonate Equivalent (LCE) capacity. Orocobre's portfolio consists of salar and spodumene lithium production assets in Argentina, Australia and Canada, and the Naraha LiOH plant in Japan. In 2012, Orocobre bought Borax Argentina from Rio Tinto's boron business. In FY2021 (June y/e) Borax Argentina reported a total of 41,007t of combined product sales (borax chemicals, boric acid and boron minerals). At a 9% cut-off, the Porvenir deposit has a resource of 6.85Mt grading 14.9% B_2O_3 and containing 1.02Mt B_2O_3. Tincalayu has a resource (based on a 5.6% cut-off and the current production rate of 30,000tpa) of 16.8Mt at 11.7% soluble B_2O_3. An additional non-JORC resource exists at Sijes of 3.3Mt at 22.6% B_2O_3, containing 746,800t B_2O_3. For the last few years the boron business has been loss-making at the operational level, as was Orocobre as a whole, so the company does not provide investors with a sensible investment route into boron.

In Serbia, we are aware of four lithium-boron projects, together with Erin's pure boron project. The largest is Rio Tinto's Jadar project, which contains a resource of 139.2Mt grading 1.78% Li_2O and 14.7% B_2O_3 and an additional ore reserve of 16.6Mt at 1.81% Li_2O and 13.4% B_2O_3 (in its 2021 annual report, Rio Tinto has removed Jadar's ore reserves following the revoking of its permits by Serbian authorities). In July 2021 Rio committed US$2.4bn to developing the project, with first saleable production in 2026 (since adjusted to 2027) and annual target volumes of 58,000t of battery-grade Li_2CO_3, 160,000t of boric acid (B_2O_3 units) and 255,000t of Na_2SO_4. However, in January 2022, Serbia revoked all Rio's licences after protest group pressure. It is unclear what the final outcome will be, given Serbia's general election in April 2022 (we cover the sitution in more detail in the Serbia section of this note), though we anticipate that some form of compromise will be reached. We note Rio's December 2021 announcement with regards to its US$825M acquisition of the Rincon lithium brine project in Argentina.

Private Canadian company Euro Lithium has a resource of 1,696Mt grading 1.98% B_2O_3 and 0.41% Li_2CO_3 at its Valjevo lithium-boron project, relatively close to Jadar while further south-east, ASX-listed Balkan Mining & Minerals has the earlier stage Rekovac lithium-borate project and the Dobrinja and Pranjani licences. Volt Resources is also exploring in the Jadar area.

Erin Ventures' Piskanja project (June 2022 resource of 7.2Mt at 34.6% B_2O_3) is, to our knowledge, the only listed pure-play boron project available to investors.

Uses of boron

Uses – a wide range of applications

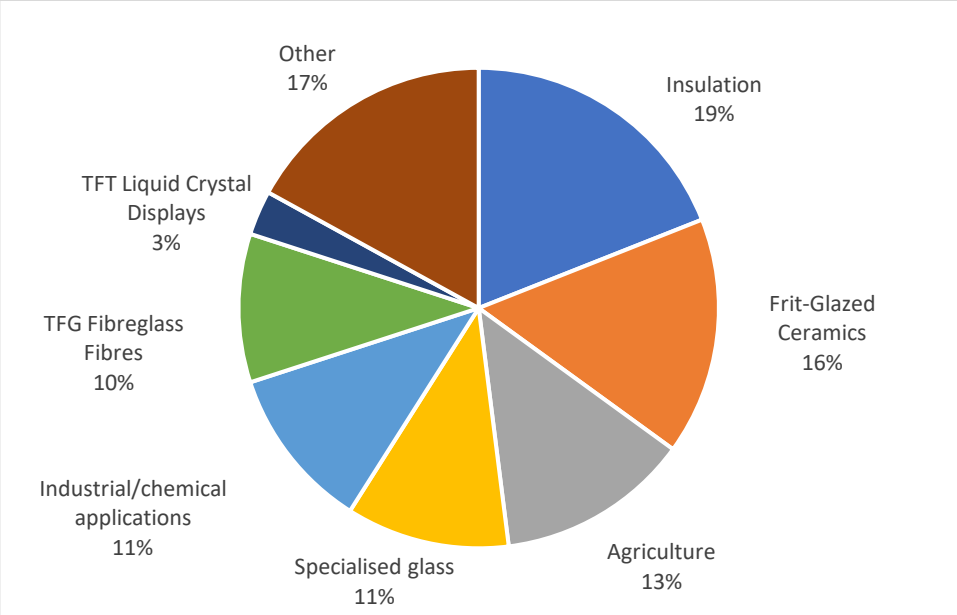
Whilst most people are totally unaware of what boron is, borates (ie boron-oxygen compounds, and typically quoted in terms of boron trioxide or B_2O_3) and boric acids (typically quoted in terms of simple boric acid or H_3BO_3) probably have a wider range of commercial applications than the compounds of almost any other element, and this can be attributed to 5 key physical properties:

- Hardness – boron composites are the second hardest material in the world, after the diamond form of carbon;
- Lightness – boron is the fifth lightest element (after hydrogen, helium, lithium and beryllium);
- Heat resistance – boron melts at 2,075 ^oC (3,771^oF) – only 11 elements have higher melting points, including carbon (diamond form), niobium, molybdenum, tantalum and tungsten;
- Corrosion resistance – boron-infused metals and ceramics reduce the propensity for corrosion;
- Anti-microbial – boron clusters have anti-biofilm activity and are less prone to drug resistance.

While there is a lot of research into new applications, the traditional, principal, uses of boron compounds have changed little in the last 10-15 years. Uses in glass (fibreglass, borosilicate glass, LCDs etc) make up around 24% of total demand globally and this proportion has risen in recent years, and given its application in solar cells, growth in glass is likely to continue. Other key uses include insulation, enamels and frits, and fertilisers. Bleaches, detergents and washing powders are other major uses. Boron fibre-reinforced plastics are used in aerospace frame sheathing, combining flexibility and light weight with strength and ease of fabrication. Borates are also used in applications like wood preservatives and insecticides, industrial fluids (fuel additives, brake and hydraulic fluids, lubricants), alloys and amorphous metals (boron steel in the automobile industry, for

instance), fire and flame retardants, pharmaceuticals and cosmetics, abrasives, adhesives, anti-corrosion compounds, various metallurgical processes, nuclear shielding and a number of new and emerging technologies and developments. Significantly, in almost all of its applications, borates cannot be substituted.

Figure 5: World borate end-uses



Source: C. Helvaci. (2021). Borates:Encyclopedia of Geology, 2nd ed., vol.1, eds. D.Alterton , SA Elias. TFG: textile fibre glass; TFT: thin-film transistor

New applications – underestimated by investors

Every investor will be aware of the "green" trend – global warming and efforts to achieve Net Zero Carbon, as well as the impact of China in almost every commodity market. This has given rise to a surge of interest in explorers, developers and producers of, for instance, lithium, graphite and Rare Earths. However, given the lack of investment opportunities in boron, the market has simply not noticed that this "green" trend is also a big positive for boron, and in our view that could soon change, to the benefit of the only pure play in the boron space, Erin Ventures.

For instance, investors will be well aware of the use of Rare Earths (and in particular neodymium and praseodymium, or NdPr) in the magnets needed for the motors in electric vehicles (EVs) and wind turbines. But these magnets are really better labelled NdFeB magnets, and contain 1-1.2% boron.

Environmental applications include aiding the recovery of heavy metals in industrial waste and the purification of polymers used to bleach wood pulp by the paper industry. Other rapidly evolving technology that requires boron includes B-Fe-Si electrical transformers and applications in biological growth-control agents. In medicine, borates help to control the refractive index in optical fibres in medical research and are used in some cancer treatment applications. Research is ongoing into radiationless hydrogen-boron fusion for nuclear energy, as well as in fuel cells and energy storage. Boron nitride also has applications as an adsorbent for CO_2 capture and in lubricants in wind turbines. In lithium-ion batteries for electic cars, boron is used as an electrolyte and research is ongoing for hydrogen-boron fusion to fuel electric vehicles too.

Apples and pears?

Before considering the supply/demand balance, a word of warning. We have already noted the general paucity of data in terms of reserves/resources, production, consumption and pricing data. This is compounded by the interchangeable nature of

nomenclature – it can be difficult to know whether one is comparing identical data. For instance, when Eti Maden estimates that global consumption of boron in 2019 fell 11% to 3.71Mt, are they talking about boron (B, the element), boric oxide (B_2O_3, boric trioxide or anhydrous boric acid), boric acid (H_3BO_3) or borate minerals or products collectively? The US Geological Survey, which collates global production and reserve data, for instance, does not calculate a global total for this very reason. For Turkey, they quote refined borates, while for Argentina, Bolivia, Chile, Peru and Russia, for instance, they quote the production of minerals/ore. For the US itself, no production data is given to avoid disclosing proprietaty data (Rio Tinto publishes its production data, so we assume the withheld data refers to Searle Valley Minerals, owned by private Indian company Nirma).

Figure 6: Borate conversion factors

To convert		To	Multiply by	Reciprocal
Boric oxide	B_2O_3	B	0.31074	3.218
Boric acid	H_3BO_3	B_2O_3	0.5630	1.776
Borax mineral	$Na_2B_4O_7.10H_20$	B_2O_3	0.3652	2.738
		H_3BO_3	0.6485	1.542

Source: Rio Tinto (20 Mule Team Borax)

So for instance, one tonne of boric oxide (B_2O_3), is equivalent to 0.311t of boron or 1.776t of boric acid (H_3BO_3), and one tonne of boric acid is equivalent to 0.563t of boric oxide.

Historically boron markets have been broadly balanced; consumption growth in line with global GDP growth

Eti Maden, which overtook Rio Tinto as the world's largest borate producer in 2005, sold 2.6Mt of boron products in 2021, worth over US$1bn (news release, Republic of Turkey Ministry of Energy and Natural Resources, 28 December 2021). This represented 62% of global sales, which were therefore 4.2Mt. We believe that in 2021 supply and demand were broadly balanced, and the industry globally was operating close to nominal capacity. Eti Maden anticipates having borates production capability of 5.5Mt and sales income of US$2.5bn by 2023 according to the borates.today website. Over the last decade (2012-2021) we believe that borate demand has grown by a CAGR of c.4.0%, as estimated by Shaw and Partners (1 July 2021, Amercian Pacific Borates research note, available on the ABR website) to c.4.5Mt of boric acid equivalent (H_3BO_3). Between 1961 and 2020, global GDP has grown by c.3.9% according to Macrotrends, so broadly speaking, global boron consumption growth is in line with global GDP. However, over the years there has been volatility. According to Eti Maden, global boron consumption rose 8% in 2018, before falling 11% in 2019 (to 3.71Mt). We do not have access to data for 2020, but the increase over the two years between 2019 and 2021 (ie over the Covid-impacted period) would appear to be around 13%, based on the Eti Maden and Ministry of Energy and Natural Resources' numbers.

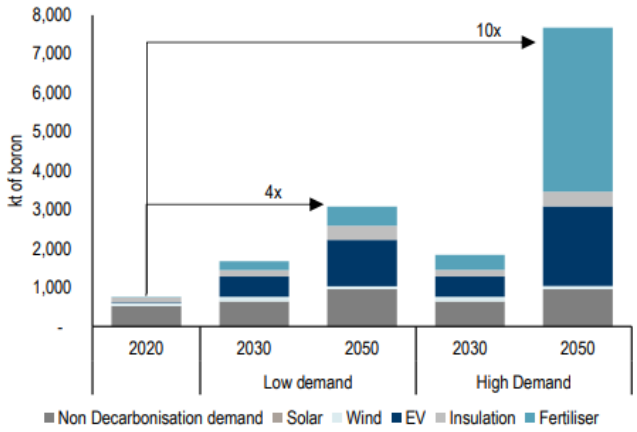
Decarbonistion to lead to supply shortfalls

While historical boron consumption growth has not been especially spectacular, broadly 4% CAGR and in line with long-term global GDP, the future may look very different. Demand in traditional non-"green" Net Zero/decarbonisation applications is likely to grow by less than the historical growth rate, perhaps in the 2-3% CAGR range. The ESG research team in Credit Suisse's equity research group has produced an invaluable research note ("Carbon Transition Super Materials – Boron-The 5th Element of Decarbonisation", 7th December 2021, available on the American Pacific Borates website). The CS team estimate a low and high demand growth scenario. Under the low demand growth scenario, boron demand could increase four-fold by 2050, and potentially as much as 10-fold under the high demand growth scenario. Under Credit Suisse's high demand growth scenario, 5E Advanced Matetrials (the renamed American Pacific Borates) estimates a c. 2Mt boric acid equivalent shortfall by 2028. There are five key pillars to the decarbonisation argument, which are:

- Renewable Energy (wind turbines – fibreglass in blades, Nd-Fe-B permanent magnets in electric motors; specialty glass in solar panels);
- Electric Vehicles (Nd-Fe-B permanent magnets in electric motors, boron steel in components);

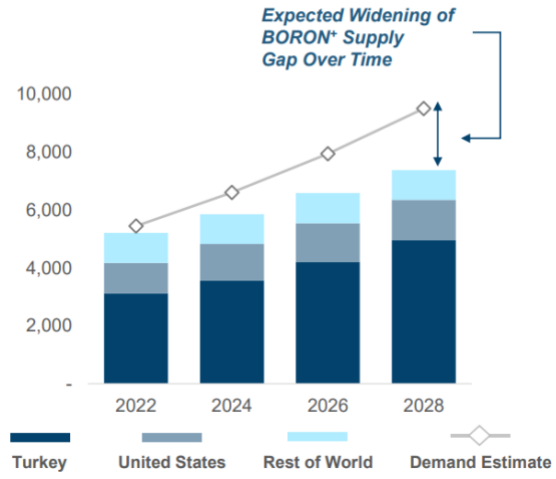
- Building Insulation Efficiency (improving standards for fibreglass insulation in new buildings and retrofitting in existing buildings);
- Energy Storage and Fuel Cells (increasing use in Li-ion and Li-S batteries and new applications in radiationless hydrogen-boron fusion);
- Micro-nutrients in fetilisers (increasing use of micro-nutrients to increase crop yields from fertilisers).

Figure 7: Boron demand growth potential



Source:Credit Suisse

Figure 8: Boric acid supply/demand imbalance (000t)



Source: 5E Advanced Materials (based on Credit Suisse High Demand case)

How much boron will decarbonisation require?

Inevitably, forecasting commmodity demand, particularly several decades out, and in particular with new technologies that are evolving rapidly, is difficult. And equally inevitably, all forecasts go from bottom left to top right of the chart – all that differs is the gradient!

For instance, on average, an electric vehicle contains 45-50kg of boron in total, in high-strength boron steel (40-46kg), the permanent magnet (0.01-03kg) and various other applications, such as brake pads for instance (0.25-0.35kg). Commodity consultants Wood Mackenzie forecast that by 2040 EV sales will hit 41M units – at an average of 50kg per EV that would imply a requirement of c.2.05Mt of boron. On the other hand, and with some apparent thrifting, Credit Suisse forecasts 1.18Mt (low growth case) to 2.05Mt (high growth case) by 2050, 10 years later. Similarly, the volume of boron used in fibreglass in wind turbine blades varies widely, in part based on the application. An offshore wind turbine can use c.6,400kg of boron compared with c.1,300kg for an onshore wind turbine. Rather than trying to second-guess boron demand as "green" Net Zero applications increasingly proliferate, we think that a conservative approach would be to assume that historical demand growth rates continue at c.4%pa with a broadly balanced market, and that a more bullish scenario, taking into account decarbonisation trends, would be to assume a shortfall of 2.0Mt of boric acid (1.1Mt of boric oxide or 350,000t of boron) by 2028, with a potential acceleration of the demand curve after that. To put this into perspective, to meet this more bullish scenario by 2028 we would require additional boron production capacity equal to twice the world's No.2 producer's capacity, ie Rio Tinto's current Mojave desert production facilities. And of course, to meet a 4-fold to 10-fold increase in demand by 2050, supply must also increase 4-fold to 10-fold.

Meeting the shortfall

While it may certainly be feasible for Eti Maden, Rio Tinto and other existing producers to increase production, we believe that major customers for boron products would welcome some supply diversity away from the duopoly of Eti Maden and Rio Tinto. There should therefore be scope for new entrants like 5E Advanced Materials (formerly known as American Pacific Borates) and Ioneer in the USA, and in Europe, potentially Rio Tinto's Jadar project and Erin Ventures in Serbia. Serbia has started the accession process to the EU, and in 2014 the EU placed borates on its critical materials list (borates were included in the updated lists of 2017 and 2020). 98% of EU borate supply comes from Turkey, so European industrial manufacturers are keen on diversification of supply. Much of the world's colemanite ore comes from Turkey, but it contains arsenic. The colemanite at Piskanja is arsenic-free, adding to its attraction for European consumers. And while borates are not on the US critical minerals list, the US government's Cybersecurity and Infrastructure Security Agency (CISA) designated 5E's Fort Cady project as Critical Infrastructure in February 2022 thus adding political expediency to the commercial interest by US boron consumers to diversify supply.

Boron pricing

Given how opaque boron markets are, price transparency is also an issue. This is compounded by the large array of boron products, and different iterations of value, and the fact that many of the key boron producers also sell uniquely formulated products. The Eti Maden website lists 24 different refined forulations, and the US Borax (Rio Tinto) website 21 formulations. The first iteration of value are the boron minerals – Eti Maden sells colemanite, ulexite and borax (tincal), for instance. The second iteration is boric acid –Eti Maden sells five formulations. The third iteration, are the boron oxides – Eti Maden sells two forms. And finally, the fourth iteration, typically with the highest prices, are boron carbides and nitrides, together with other specialty products like ammonium and potassium pentaborates and zinc borates. Eti Maden is currently constructing a boron carbide plant, for completion by the end of 2022 and the two largest producers Eti Maden and Rio Tinto) have been developing their higher value product capacity. Unfortunately, no boron producers itemise product prices, and although one can calculate an average price from revenue and production/sales data individual product sales are also not itemised, so the average is not particularly meaningful.

Received boron prices are jeolously guarded. We can tell you that in the February 2021 Enhanced Definitive Feasibility Study (DFS) for 5E Advanced Materials' Fort Cady project, a price of US$750/t was used for boric acid, and in Ioneer's Rhyolite Ridge DFS (April 2020) a boric acid price of US$710/t was used.

Looking at Rio Tinto's average selling price for 2021 (dividing gross product sales of US$592M by production (not sales) of 488,000t of B_2O_3 equivalent content, the average price was US$1,213/t, but don't forget this includes a wide range of products, some of which are very high value. Similarly for the Borax Argentina business of Allkem (formerly known as Orocobre), for FY2021 (June y/e) and dividing revenue of US$18.39M by combined product sales (borax chemicals, boric acid and boron minerals) of 41,007t implies an average price of US$448/t, again across a wide array of products, with a weighting presumably to boron minerals. Undertaking the same exercise for H1 FY2022 (the 6 months ending 31st December 2021), Allkem reports total borax sales of US$11.82M (broken down by borax, US$5.29M; borax acid US$2.82M; hydroboracite, US$2.69M and other, US$1.02m) and combined sales of 25,911t (individual product volumes were not given). This yields an average sales price of US$456/t. Allkem reports that in the March 2022 quarter, the average sales price increased 13% Q-on-Q.

In its March 2022 quarterly report, Ioneer notes that average boric acid prices increased by 50% in the quarter when compared to average pricing in 2020 and 2021, "reflecting favourable market dynamics and continued strong demand". Ioneer notes "increased pricing across a variety of boron derivatives including boric acid prices at approximately US$730 to US$1,360/ton (note: we presume this refers to short tons; 1 short ton equals 0.91 metric tonnes), depending on volume, according to third-party market research as of April 2022".

In the June 2022 Preliminary Economic Assessment undertaken independently on behalf of Erin and Temas, the Base Case model uses US$500/t for colemanite and US$700/t for boric acid, which appear to be reasonable assumptions to use based on the peer data available.

Serbia and its mining industry

Introduction

Like much of Eastern Europe, Serbia has seen an increase in exploration activity since the collapse of the Eastern Bloc, and in particular the disintegration of Yugoslavia into its constituent republics, primarily along ethnic lines. This process started in 1989, and Serbia formally declared itself indepenent in 2006. With a population of c.7.0m people, Serbia is not a member of the EU, but is currently an EU accession candidate. Whether a member of the EU or not, the country could be a useful supplier of certain critical raw materials to the EU. Serbia's mining industry is currently centred in the Timok region where a number of copper-gold mines are in operation. Exploration elsewhere in the country has in recent years primarily been for gold, zinc-lead-silver, lithium and boron, and a number of companies from the UK, Canada and Australia have been active in the country. At the national government level, the country has been a welcoming one for the mining industry, with politicians keen on generating income and job creation. The government has said that it anticipates that mining will build its contribution to GDP from 2% to 4-5% within 10 years.However, as in many other jurisdictions around the world, at the local stakeholder level, residents and administrations, supported by active NGO's, have been less welcoming, and we discuss this in more detail later.

Mining in Serbia today

The Timok Magmatic Complex

The Timok Magmatic Complex, in eastern Serbia, close to the borders of Romania and Bulgaria, is currently the most significant minng district in Serbia. It includes the former state-owned RTB Bor business, which includes three open-pit and underground copper-gold mines (Bor, Veliki Krivelj and Majdanpek) and a copper smelter/refinery complex. In 2018, Chinese mining company Zijin Mining paid US$1.26bn to acquire a 63% interest (the Serbian government retains the balance), and promised to invest US$1.9bn over 6 years. Zijin is investing to expand the renamed Serbia Zijin Copper, and once the expansion is complete, Zijin forecasts annual production of 120,000t of mined copper and 180,000t of refined copper.

Zijin completed the acquisition of Nevsun in 2019. Nevsun's premier asset was the Čukaru Peki copper-gold project also in the Timok region, and just 5km from the Bor mine. Investors may well remember the furore over Čukaru Peki, which was one of the most significant copper-gold discoveries of recent years. The project solicited a number of takeover battles, first (in 2016) for Freeport McMoRan's stake in the project, then for Reservoir Minerals, and finally for Nevsun. Zijin paid C$1.86bn for Nevsun (which also operates a smaller Cu-Zn mine at Bisha, Eritrea), and then spent US$474M on developing Čukaru Peki as well as paying Freeport McMoRan a further US$240M (possibly rising to as much as US$390M) to acquire its residual 39.6% of the Lower Zone at Čukaru Peki (completing its 100% ownership of the whole project). Commercial production on the Upper Zone at Čukaru Peki started in October 2021 and Zijin anticipates annual copper production of 91,400t Cu and 80,000oz Au, with peak annual production of of 135,000t Cu and 200,000oz Au. When at full mine production, Zijin's Timok assets are likely to be Europe's second largest copper business, after KGHM in Poland.

A number of companies are exploring for copper-gold and gold orebodies in the Timok Magmatic Complex. The most advanced project is the Timok gold project of Dundee Precious Metals. Feasibility Study results are expected in Q2 2022. The PFS indicated an 8-year mine life, averaging 70,000ozpa Au with an after-tax NPV (5%) of US$135M and a 20.6% IRR (based on a US$1,500/oz gold price). A number of other companies are exploring in the Timok area including Mundoro Capital and Raiden Resources.

Figure 9: Serbia: location of Timok and boron deposits

Source: Map – UN; locations – company websites . (1) Timok Magmatic Complex – Zijin Mining Cu-Au mines (Bor, Majdanpek, Veliki Krivelj, Čukaru Peki) and smelter; Dundee Precious Metals, Mundoro Capital, Raiden Resources, exploring for Au and Cu-Au; (2) Rio Tinto Jadar Li-B project, Volt Resources Jadar North licence; (3) Erin Ventures/Temas Resources Piskanja B project; (4) Balkan Mining & Minerals Rekovac Li-B project; (5) Balkan Mining & Minerals Dobrinja & Pranjani Li-B licences; (6) Euro Lithium Valjevo Li-B project, Volt Resources Ljig licence; (7) Volt Resources Petlovaca licence

Boron in Serbia

Turning to boron in Serbia, most projects identified to date are lithium-boron deposits. This includes Rio Tinto's Jadar project, which is both one of the world's largest undeveloped lithium projects and also boron projects. Other lithium-boron exploration projects in the country are managed by Balkan Mining and Minerals, Euro Lithium, a private Canadian company, and Volt Resources. The Piskanja project, owned 50/50 by Erin Ventures and Temas Resources, is the only pure boron project. These projects, shown on Figure 9, are all located in the Vardar Zone, a geological trend that also includes Eti Maden's key borate deposits in Turkey. The Serbian peer assets are described in more detail on page 31.

Other production and exploration

Elsewhere in Serbia, the private UK-based company Mineco operates three modest base metal mines in Serbia, Rudnik (Pb-Zn-Cu) in central Serbia, Veliki Majdan (Pb-Zn) in western Serbia, close to the border with Bosnia-Herzegovina, and Bosilegrad (Pb-Zn) in eastern Serbia, close to the Bulgarian border. Mundoro has a copper exploration project, GT7, 40km SE of Rudnik in central Serbia, near Kraljevo. Also in base metals, Adriatic Metals is exploring for zinc-silver at Raska, relatively close to Erin's Piskanja boron project. Raiden Resources also has a number of other early-stage base metal exploration programmes while Medgold Resources has been trying to sell its Tlamino gold project in south-east Serbia. A 2021 PEA indicated a project with an 8-year mine life, a post-tax NPV (8%) of US$86M and an IRR of 46%, and with annual production averaging 50,000oz Au and 500,000oz Ag.

Permitting process and tax/royalty regime

Serbia has a 15% corporate tax rate and a royalty of 5% on metals produced in the country. Exploration permits can be granted for 8 years (an initial 3 years, with a renewal of 3 years followed by 2 years). The term of the exploitation permit is based on the mine plan. Mine permitting consists of 8 inter-related (and often overlapping) workflows, that cover:

- Land Acquisition
- Spatial Planning
- Strategic Environmental Assessment
- Nature Conservation
- Cultural Heritage
- Water Permit
- Mine Waste Plan
- Environmental Impact Assessment

There is also a permitting sequence:

- Exploration Permit
- Serbian Technical Study and Certificate on Resources and Reserves (CoRR)
- Serbian Feasibility Study
- Mine Exploitation Permit
- Permit for Construction Works and Mine Works
- Permit to Use Mining Objects

For foreign companies, these studies will be based off (but different to) the JORC or NI 43-101 studies undertaken by the company.

Political landscape in Serbia

A populist coalition, led by the Serbian Progressive Party (SNS) came to power after the 2012 general election. Aleksandar Vučić, was appointed Deputy Prime Minister in 2012, Prime Minister after the 2014 election, and was elected President in 2017.

Ana Brnabić became Prime Minister in 2017, initially serving as an independent, but joining SNS in 2019. The SNS won the 2020 election as well. Since 2017 there have been periodic mass protests against the government, and the coalition disintegrated in early 2021. A referendum was held in January 2022 where the people of Serbia voted in favour of constitutional changes. In October 2020, the President said that a general election would be brought forward from the due date in 2024. The general election and presidential election, as well as Belgrade City Assembly and local elections were held on 3rd April 2022.

Serbia's 2022 elections

In the latest series of elections, held on 3rd April 2022, President Aleksandar Vučić won a landslide victory in the First Round of the presidential election, gaining a further 5-year term with almost 60% of the vote. In parliamentary elections, his party, the Serbian Progressive Party (SNS), won c.43% of the vote and will once again dominate the 250-seat National Assembly, while its partner party, the Socalist Party of Serbia (SPS), won c.12%, meaning that the SNS should retain power, but only with the support of the SPS. Overall, the ruling SNS party lost votes and seats in parliament relative to the 2020 election. The green-left coalition, Moramo, did surprisingly well, entering the National Assembly for the first time with 13 seats. In addition, the SNS did worse than expected in elections for the City Assembly of the capital, Belgrade. In 2018, the SNS (and another party that has since been merged into it) won 54% of the vote and 76 seats (out of a total of 110 in the City Assembly) – in 2022, the SNS lost 16% of the vote and 28 seats. Opposition parties have called for new elections. Vučić (and the majority of Serbians) are pro-Russian, so events in the Ukraine may have had an impact on results. Vučić is also pro-mining. His strong standing in presidential elections, the weaker performance of the governing party in the National and Belgrade city Assemblies, the emergence of Moramo and the environmental movement, together with pro-Russian and anti-western sentiment, may have an impact on future mining sector policy. While it is too early to tell what the impact on the mining sector may be, we expect to see a compromise that will allow mining and exploration companies to operate.

Local stakeholders protest against mining

As in many countries around the world, while governments at the national level are keen to promote mining as a source of wealth and job creation, at the local level this is often not the case. Environmental protests began in January 2021, but have escalated since last September. Environmental organisations like Ecological Uprising, Kreni-Promeni and Assembly of Free Serbia have played a key role in most protests, in support of local residents and local government.

Jadar judders to a halt

By the end of 2021, the latest, and most well publicised issue was Rio Tinto's Jadar project, (but other mining and exploration ventures have also experienced challenges). Jadar has become the catalyst for environmental debate given its potential significance. The project was expected to make a 1% direct and 4% indirect contribution to Serbia's GDP, and create c.2,100 jobs during construction and 1,000 ongoing jobs when operational. Rio Tinto has been in Serbia since 2004 when the Jadar deposit was discovered. The project did have the support of the government, but public concern about a potential new law on expropriation (compulsory acquisition of land by the state for projects) coupled with environmental concerns (including the introduction of punitive administrative fees which protestors fear will curb initiatives against polluting projects) were compounded by Rio Tinto's July 2021 announcement of its commitment to spend US$2.4bn on developing the project.

December 2021 saw protests of, reportedly, at least 100,000 people demonstrating, blocking roads, and committing acts of violence in Belgrade. The national government capitulated, withdrawing the proposed expropriation law and revoking Rio Tinto's project licences in January 2022. Most political parties, and a number of national celebrities supported the protestors. It is also worth pointing out that Rio Tinto is an Anglo-Australian company and the timing of the revokation of licences coincides with the Covid-related visa cancellation for Serbian tennis star Novak Djokovic by the Australian government. This may, or may not, be connected, but certainly will not have helped public sentiment towards the Jadar project. Reuters reported (20th January 2022) that the Serbian Prime Minister, Ana Brnabić, commented "All decisions (linked to the lithium project) and all licences have been annulled. As far as Project Jadar is concerned, this is an end". Reuters reported that Rio Tinto was reviewing the legal basis for the revokation. Notwithstanding the revokation of licences at Jadar, environmental protests continue.

Given that SNS was re-elected, it will be interesting to see whether Rio Tinto will be able to resume work on Jadar with perhaps a renegotiation of environmental requirements and an increase in royalties/taxation, or whether there will be additional implications for others miners and explorers in Serbia. Certainly, the Prime Minister (Brnabić) has also said that a decision should be made after the election "by the political elites that will lead the country in the next four years" (Mining Journal, February 2022 issue). President Vučić apparently still supports the project though last year stated that a plebiscite by the public could influence final approval. Finally, at the local level, the municipal assembly of Loznica, near the Jadar minesite, had scrapped land allocation plans following protests.

The most recent comments on Jadar from Rio Tinto were made by the company's Chief Executive, Jakob Stausholm, following the company's annual shareholder meeting in Melbourne on 5th May. Stausholm said "We have certainly not given up on Jadar – I think it's a perfect project. I'm very hopeful that common sense will prevail and we enter a dialogue" (The Age, 5th May 2022), while Chairman Simon Thompson (who stepped down at the end of the AGM) said "We very much hope that we will be able to discuss all the options with the government of Serbia now that the elections are out of the way". Thompon also said that under Serbian rules the company could not release its environmental and social impact review ahead of gaining government approval, resulting in misinformation circulating ahead of the election (Reuters, 5th May 2022). We anticipate that some sort of compromise will be reached.

Legacy issues and recent pollution at Bor

Copper mining at Bor, in the Timok region, started in 1904, and the operation was nationalised in 1951. China's Zijin Mining took control in 2018 and now owns 63%, with the Serbian government holding the remaining 37%. Like all old mining areas around the world, the region is blighted by historical environmental and pollution issues impacting water and air quality. Much of the pollution stems from legacy issues, well before Zijin came on the scene, but the company has been subjected to a number of protests since it took over operations, relating primarily to excessive air pollution caused by high sulphur dioxide levels, as well as arsenic, iron, nickel and cadmium. In September 2020 the city of Bor filed a criminal complaint against Serbia Zijin Copper following evidence that SO_2 levels as high as 2,285micrograms/cubic metre had been recorded – well above the legal cap. As a result, Zijin elected to temporarily shut the copper smelter. The government reportedly ordered the company to stop work again in April 2021 (Mining Technology, 15th April 2021) due to non-compliance with environmental standards, and ordered the company to complete a wastewater treatment plant to avoid polluting the river Pek. A Zijin press release (4th August 2021) noted that some historical pollution levels were as high as 5,000 micrograms of SO_2, 10 times the allowed level of 500 micrograms, but that from August 2021, the introduction of a flue gas treatment system would lower these levels by 95% while polluting particles will be converted into gypsum and sold to the construction industry to make plaster. A Zijin press release (15th November 2021) notes that the company has spent US$143M on environmental remediation, with further investment planned. This is more than double the US$70M required in the strategic cooperation agreement that Zijin signed up to (Balkan Insight, 21st October 2021). Chinese companies are not known for adhering to the best environmental standards, but Zijin does appear to be addressing these legacy issues.

Cyanide concerns for Dundee

On 31st December 2021, balkangreenenergynews.com published an article concerning Dundee Precious Metals' Timok gold project stating that environmental and local associations were campaigning against the mine development because of concerns that cyanide (to be used in processing the ore) would endanger local water supply, impacting the local farming community and beyond (the region is apparently the largest drinking water reservoir in the country). Over 12,000 signatures against the mine have been collected by the Kreni-Promeni platform. The Deputy Prime Minister and Minister of Mining and Energy, Zorana Mihajlović, has apparently stated that the use of cyanide in ore processing will not be permitted.

Euro Lithium licence status in doubt

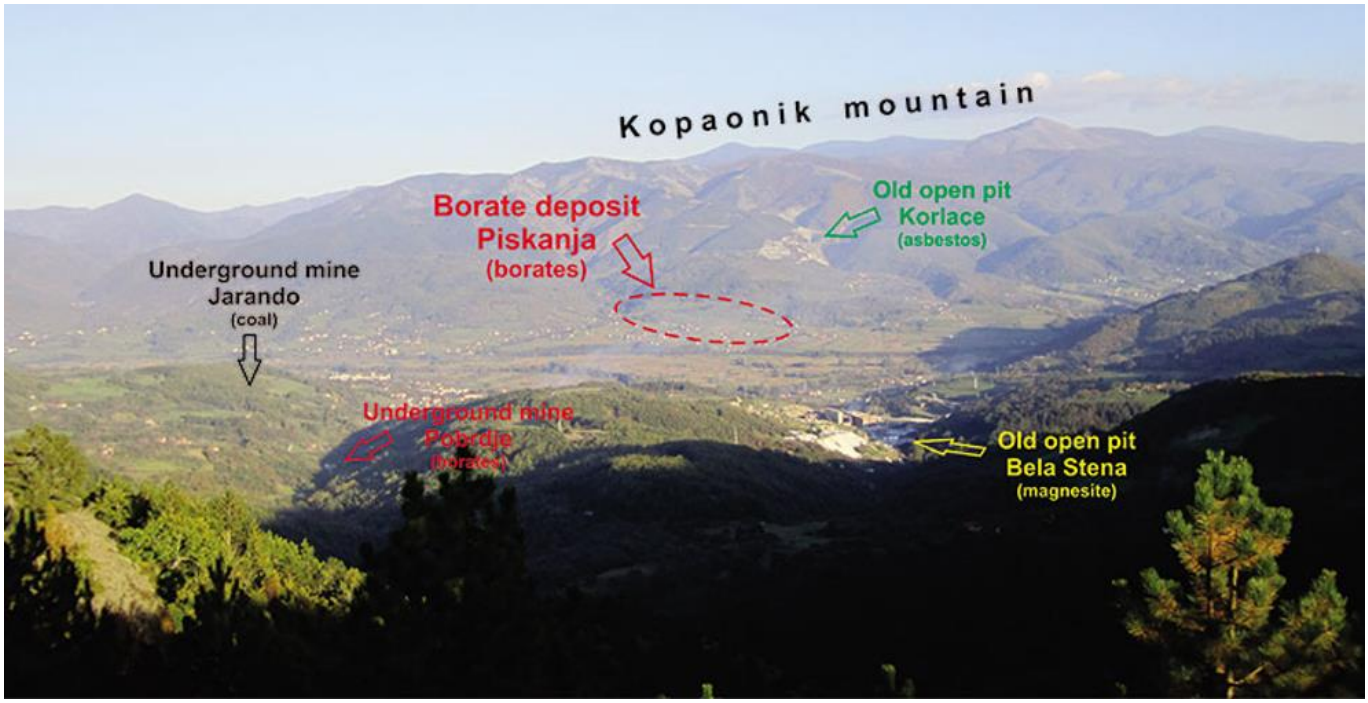
Private Canadian-based Euro Lithium, which hopes to extract lithium and borates at Valjevo, has also run into environmental challenges. The company's exploration licence expired at the end of October 2021 and environmental pressure group March

from Kolubara joined the procedure to prevent the renewal of the permit, which was due to be renewed at the end of February 2022 (borates.today website, 22nd February 2022). It is unclear what the current status of the project is.

Issues for Balkan Mining and Minerals

On 28th October 2021, balkangreenenergynews.com published an article concerning lithium-boron exploration by Balkan Mining and Minerals. The article notes that locals in the Rekovac area have demonstrated against and blocked efforts by the company to explore in the area. According to the article, locals, the community council and the municipal authorities were unaware that a licence had been granted. The company had apparently had the same issues at its other licences at Dobrinje and Pranjani.

Figure 10: Location of historical mining activity in close proximity to Erin's Piskanja project



Source: Erin Ventures

But no issues for Erin

In sharp contrast to the experience of other operators, Erin reports that it has not been faced with the same challenges. Erin notes that boron is a safe commodity and that its colemanite is free of arsenic (unlike the deposits in Turkey, the world's largest source of colemanite ore). It notes that the proposed mine will have a small surface footprint (c.5ha only) and that mining will be by underground methods, with waste material reintroduced to the mine and cemented back in place for safe and permanent disposal. The company also cites widespread local support for the Piskanja project. Whilst a few locals have refused to allow Erin access to their land for drilling, the Piskanja project has the support of the local miners' union, many local politicians and businesses, and the majority of the local population. The region has a strong mining culture – coal has been mined in the area for over 100 years, but these operations are currently being decommissioned, and will close within 2 years. The region has no commercial agriculture, is sparsely populated and has suffered population loss due to the lack of jobs in the area. Erin expects to employ around 200 people, many of whom are likely to come from the local coal mine as it closes. The Piskanja project is on land owned by the government and already zoned for industrial use, being used for the surface facilities of the closing government-owned coal mine. The ground that Erin intends to use for its surface facilities has not been used for a decade.

The Piskanja boron project, Serbia

History

Erin Ventures was first granted an exploration licence for the Piskanja borate deposit in 2010. A Preliminary Economic Assessment (PEA) was completed in September 2014 in accordance with Canadian NI 43-101 guidelines. A NI 43-101-compliant Mineral Resource Estimate Update, effective July 2016, was released in October 2016 and amended in February 2019. In December 2020, Erin signed a Letter of Intent (LOI) with Temas Resources on a joint venture deal that was completed in July 2021. Temas has the irrevocable right and option to earn up to a 50% undivided interest in Balkan Gold (Erin's 100%-owned subsidiary and licenceholder for the Piskanja Borate Project) in return for work expenditures of up to €10.5M (equivalent to c.US$11.1M) on the property, and 250,000 Temas common shares and 250,000 Temas common share purchase warrants. Costs above this sum will be split 50/50 between Temas and Erin. Erin remains operator until such time as Temas has earned its 50% interest, at which point Temas will become the operator. In October 2021 the joint venture partners commissioned an updated PEA and a Geological Elaborate (a Serbian-compliant technical study similar to a PEA and required as the first step in obtaining a mining licence). Details from the revised PEA were released in June 2022 and, together with older NI 43-101 documents, form the basis of the bulk of the following project description and the economic analysis.

Location and infrastructure

The Piskanja project covers an area of 3.057 km^2 (305.7ha) and is located in south-central Serbia, 17km north of the border with the self-declared independent republic of Kosovo (Serbia has not recognised the separation of Kosovo) and is 160km south of the Serbian capital, Belgrade (a 4-hour drive from Belgrade to Piskanja), and 11km north of the small town of Raška (population c.6,500). The nearest settlement, Baljevac na Ibru (population c. 1,500) is 1.7km from the centre of the exploration licence. A passenger and freight railway passes through the western part of the licence area. Piskanja is in a historical mining region, primarily for coal (in Serbia) and lead-zinc (in Kosovo), and has good infrastructure – roads, rail, power – and experienced miners in the area. The small Ibarski Rudnici coal mine, located in Baljevac na Ibru, is due to close over the next 2 years, and a local magnesite mine has also closed, both of which are sources of experienced mineworkers. Erin currently has a small office at the coal mine with core logging, sampling and storage areas. The licence area has easy access to water and electricity. While some local landowners have refused to allow access to their land for exploration drilling on some occasions, this has not impacted the drilling programme to date (though may potentially present a challenge for future infill drilling). The company intends to acquire brownfields industrially-zoned land for its mining operations, construction and surface facilities from the state-owned Ibarski Rudnici coal mine as it winds down operations and closes.

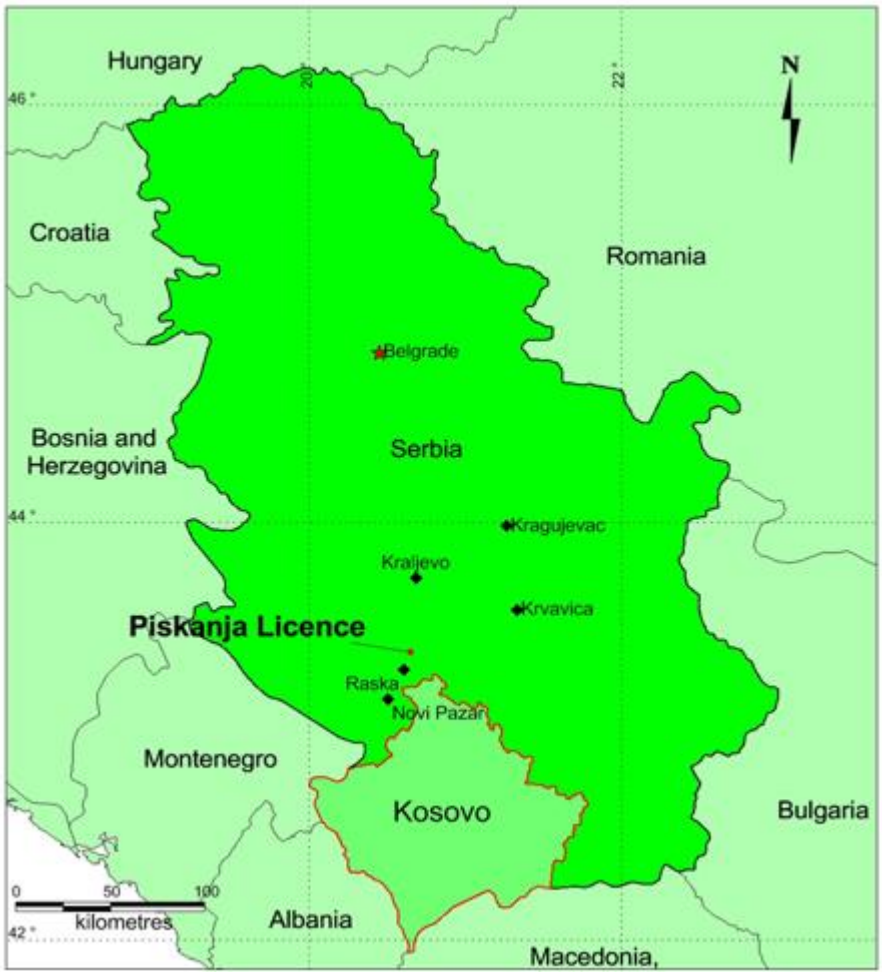
Exploration licences and mining rights

The Piskanja Licence (Licence #1934) was first granted to Erin in August 2010 and has been renewed 4 times. The current exploration licence expires on 25th September 2023.

Apart from the new Canadian NI 43-101-compliant Preliminary Economic Assessment (PEA), details of which were issued in a news release dated 27th June 2022, the company is also working on the Geological Elaborate, which is essentially a slightly more complicated Serbian-compliant version of the PEA which will take a few more months to complete and is required to get a mining licence.

In 2015 the Serbian government added boron and lithium to its list of Strategic Minerals (note that the EU added borates to its second Critical Raw Materials list in 2014, and it remained on the third list in 2017 and the current, fourth, list in 2020). The main impact for Erin of boron being designated strategic in Serbia is that the company now has 3 years after the completion of exploration to submit documentation to the Serbian government for exploitation (non-strategic minerals only have a two-year window).

Figure 11: Location of the Piskanja Licence

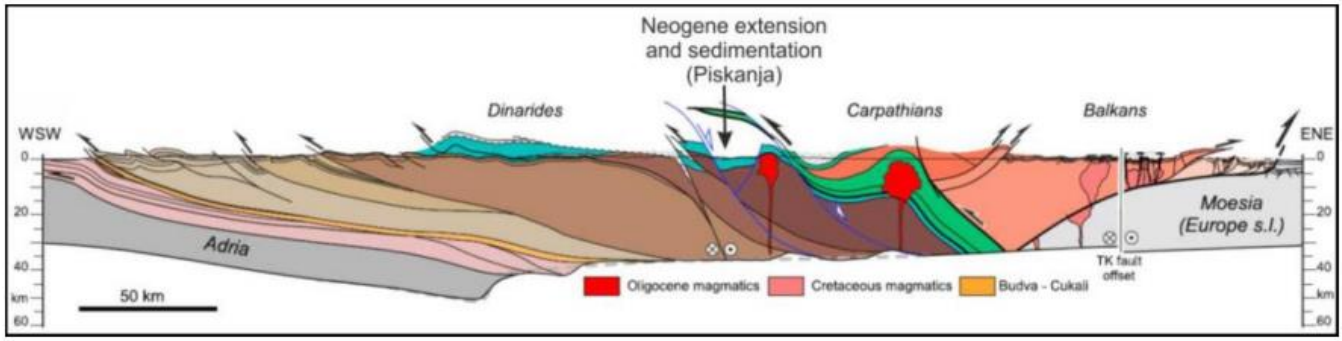


Source: Erin Ventures' June 2022 NI 43-101 PEA

The PEA and the Elaborate are precursors to the next stage, a Feasibility Study and Environmental Impact Study that must be completed to allow for the application of the mining licence by the expiration of the exploration licence in September 2023. Erin hopes for this to take place in H1 2023. The company also intends to buy certain surface rights owned by the state-owned coal mining company Ibarski Rudnici Coal Company which is closing its operations.

A royalty is likely to be payable to the government, though it is not clear at which rate. Other evaporite minerals like gypsum, salts and salty solutions bear a royalty of 1% of income, as do "technogenic" raw materials resulting from exploitation and refining of mineral raw materials. On the other hand, the royalty on non-metallic raw materials is 5% of income.

Figure 12: Regional E-W cross-section approximately coinciding with the location of the Piskanja deposit



Source: Erin Ventures' May 2022 NI 43-101 PEA (modified from Matenco & Radivojević 2012)

Geology

Regional setting: the Vardar Zone

The Piskanja deposit is located within the Jarandol Basin, a Neogene age (23-5Ma) continental sedimentary basin located within the Vardar Zone tectonic belt. The host rocks include various sedimentary rocks, such as mudstones, sandstones, carbonates (primarily dolomite), tuffaceous sediments and conglomerates. Hydrothermal and tectonic activity is thought to have led to borate mobilisation and deposition as a series of stratiform lenses within the basinal carbonate sediments. The key borate minerals are colemanite, ulexite and howlite, of which colemanite is the most significant.

Figure 13: The boron and lithium deposits of the Vardar Zone

Source: Balkan Mining & Minerals

The Vardar Zone (VZ) tectonic belt stretches from northwestern Serbia, through Kosovo and Greece, and into Turkey. It consists of ultrabasic blocks (igneous and meta-igneous rocks with a very low silica content) separated by fractured ophiolites (oceanic crust and underlying upper mantle rocks that have been uplifted and often emplaced onto continental crustal rocks) that represent Triassic-Jurassic ophiolitic paleo-rifts (where the Earth's tectonic plates move apart). The western VZ ophiolitic unit represents a suture zone (the joining, along a major fault zone, of separate tectonic plates) between the Adriatic Plate (Western Serbia) and the European Plate (Eastern Serbia). The Piskanja deposit is located in continental sediments associated with fluvial, lacustrine and swamp settings.

The VZ includes all the known borate and lithium-borate deposits of Serbia, including Rio Tinto's Jadar project, Euro Lithium's Valjevo project, Balkan Mining & Minerals' Rekovac, Dobrinja and Pranjani licences, Volt Resources' Jadar area licences as well as Erin's Piskanja and the Serbian government's Pobrdje projects. Project Kop d.o.o. (Belgrade) has a licence for boron, magnesite anf zeolite in the Jarandol basin, west of Piskanja, and Company Balkan istrazivanje d.o.o. (Belgrade) has five early-stage exploration licences for boron and lithium in central Serbia. In Turkey, the Vardar Zone also includes Eti Maden's significant Kestelek, Susurluk-Bigadiç, Emet and Kirka boron mines.

Local geology and mineralisation

The following cross-section (Figure 14) illustrates that the sedimentary rock sequence is immediately underlain by dacite-andesite (volcanic rocks) and/or dacite-andesite volcanoclastites (a rock made up of fragmented dacite and andesite volcanic rocks), and then by serpentinite (a metamorphic rock formed from igneous ultramafics mostly composed of serpentine-group minerals and typically associated with ophiolites). There are three main sedimentary rock packages at Piskanja, which in total are almost 560m thick in places. TcP1 (90-130m thick) consists of breccia, conglomerates and sandstones, with coarse clastic sediments (consisting of broken fragments of older rocks) and some interlayers of carbonate rocks. The TcP2 unit (up to 330m thick) is primarily made up of claystone and carbonates, and consists primarily of claystone and silty claystone, tuff, travertine, dolomite and dolomitic limestone with claystone. The third unit, TcP3, is 20-90m thick and is an interbedded claystone and sandstone unit with interspersed dolomitic carbonates.

The boron mineralisation is thought to be derived from volcanic geothermal springs and deposited in a restricted inter-montane basin occupied by a perennial saline lake. Mineralisation is correlated laterally with carbonate horizons. Mineralisation consists of the borate minerals colemanite, ulexite and howlite and takes different forms – massive mineralisation within laminated carbonate rocks, minor veinlets parallel to the stratigraphy, and in breccias hosted by siltstones and claystones.

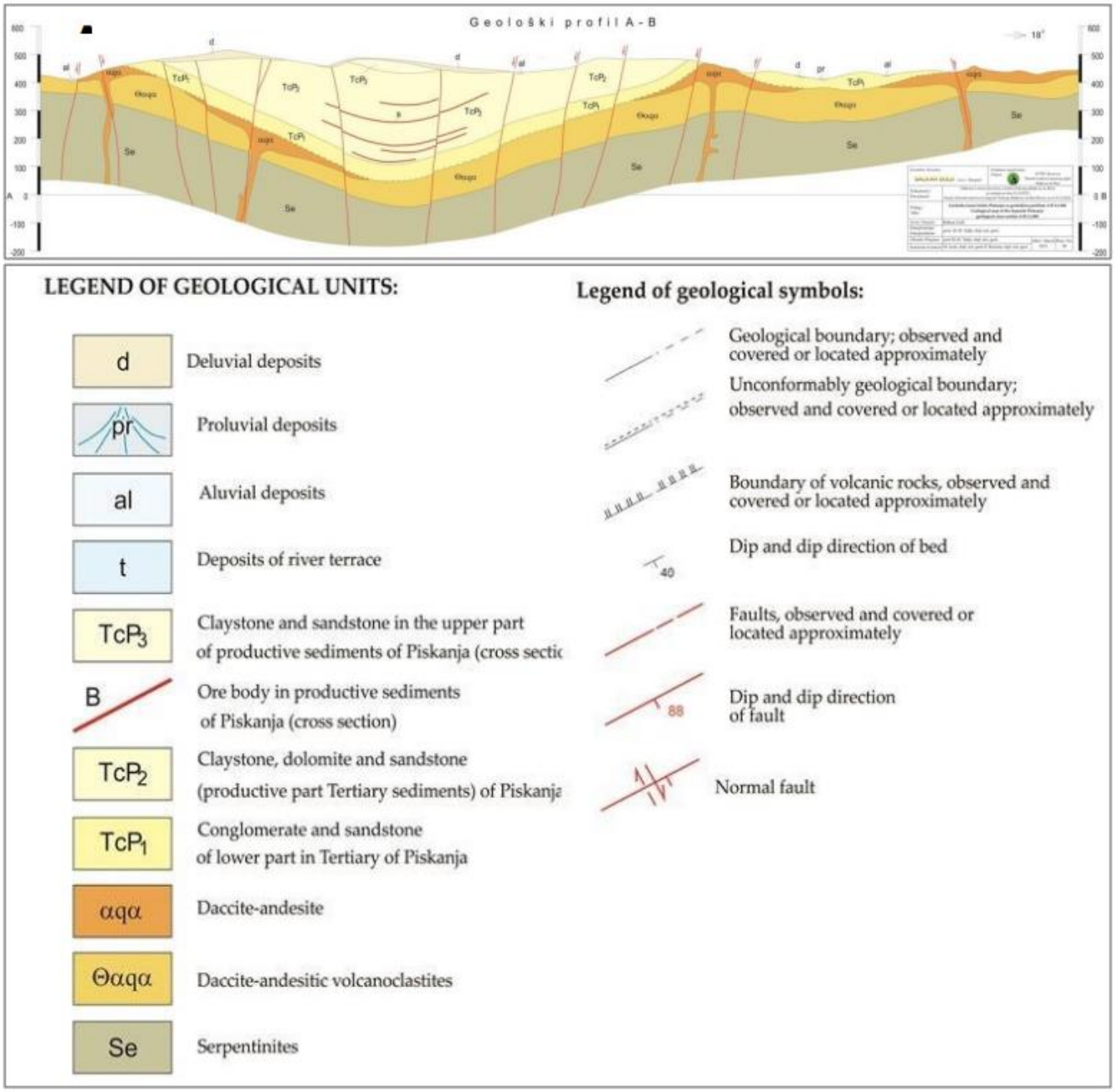
Exploration history

Boron mineralisation in the Jarandol Basin was first discovered in 1967 by a Yugoslav state-organised prospecting programme. Subsequent geological mapping identified boron mineralistion at Pobrdje, 2.6km NW of Erin's exploration licence. Geochemical studies started in 1979 and between 1987-1992 state-owned Ibar Mines completed a number of soil and stream sediment sampling programmes and an initial drilling programme of 22 diamond-drill (DD) holes which intersected boron. In 1997 Ras Borati doo, a 50:50 joint venture between Erin Ventures and Elektroprevreda doo, acquired the Piskanja licences and undertook a limited 10-hole reverse circulation (RC) drilling programme. Following the break-up of Yugoslavia, Rio Tinto acquired the project in 2006. In the public tender process the Serbian government quoted potential reserves of boron ore of 7.5Mt with an average grade of 36.39% B_2O_3 (this reserve is neither NI 43-101 nor JORC compliant). In 2006-2007 Rio Tinto undertook further exploration work including geophysical surveys and drilled 16 holes. Rio Tinto was searching for a low resistivity zone representing hydrous mineralisation. Rio Tinto decided that the results were inconclusive and dropped the licence, which was acquired by Balkan Gold doo, a wholly owned subsidiary of Erin Ventures, in 2010.

Erin has undertaken three drilling programmes. The first, in 2011-2012, consisted of 37 diamond core (DC) holes for a total of 13,568m drilled and providing 100m x 100m coverage across the deposit. A further 11 DC holes were drilled in 2015, totalling 3,458m. This smaller programme was designed to increase the sample coverage to 50m x 50m within the central part of the

deposit. In 2018, a third phase of drilling was undertaken, consisting of 10 DC holes with a total of 3,084m drilled. Together with drilling by earlier operators (Erin has access to the data), 108 holes totalling 35,964m have been drilled. Apart from drilling, Erin has geologically mapped the Piskanja licence, acquired available historical data and re-logged historical drill core where available. Other work undertaken includes a density study, while mineralogical and sedimentological studies have been undertaken as have preliminary laboratory tests on the borates. A hydrogeological study is also underway.

Figure 14: Cross-section of the stratigraphy and geological structure of the Piskanja area



Source: Erin Ventures' February 2019 NI 43-101 Mineral Resource Update (after Erin 2013)

Between 2013 and 2018 Erin also held a larger Jarandol Basin exploration licence covering 20.97km^2 and located adjacent to and between Erin's Piskanja licence and the Serbian government-owned Pobrdje deposit, which is 2.5km from the Piskanja

project and on the opposite edge of the basin. In 2015 Erin drilled 8 DD holes that intersected borate mineralisation. The decision to drop the licences in 2018 was to allow the company to focus on Piskanja. Erin reacquired an interest in the licence in January 2020.

Mineral resource evolution

Piskanja is at a relatively early stage of assessment and no ore reserves have yet been estimated for the deposit. Mineral resources do not have demonstrated economic viability, but the company hopes that it will be able to upgrade at least a proportion of the identified mineral resources into an economically viable mined ore reserve.

Erin first reported an indicated and inferred mineral resource effective October 2013 totalling 11.8Mt and grading 29.9% B_2O_3 for a total contained 3.53Mt of B_2O_3. This was revised slightly in October 2016, following the 2015 drilling programme which gave better definition to the central portion of the ore deposit, and allowed for an increase in indicated resource to 7.8Mt at a slightly higher grade of 31.0% B_2O_3. The total tonnage dropped slightly, to 11.2Mt, but with a higher grade of 30.4% B_2O_3 and a slightly lower overall B_2O_3 content of 3.4Mt. In February 2019, Erin published an Amended Mineral Resource Estimate under Canada's NI 43-101; the resource figures were unchanged from those published in the October 2016 NI 43-101.

The June 2022 resource estimate, revised as part of the new PEA, contains a smaller total mineral resource tonnage (7.2Mt), a higher grade (34.6% B_2O_3) and lower contained B_2O_3 at 2.47Mt. However, for the first time a measured resource is reported. The new estimate is based on a 12% B_2O_3 cut-off, a minimum mining thickness of 1.2m, and selling prices of US$500/t colemanite (40% B_2O_3) and US$700/t boric acid. The mineral resource was based on 58 diamond dillholes drilled by Erin and 5 drilled by Rio Tinto, with a total length of 22,618.7m.

Figure 15: Mineral resource evolution (NI 43-101)

Date	Category	Tonnage (Mt)	Grade (%B_2O_3)	Contained B_2O_3 (Mt)
Oct-13	Indicated	5.6	30.8	1.73
	Inferred	6.2	28.8	1.80
	Total	11.8	29.9	3.53
Oct-16/Feb-19	Indicated	7.8	31.0	2.4
	Inferred	3.4	28.6	1.0
	Total	11.2	30.4	3.4
Jun-22	Measured	1.4	35.6	0.50
	Indicated	5.5	34.1	1.87
	Inferred	0.3	39.6	0.11
	Total	7.2	34.6	2.47

Source: Erin Ventures

Evolution of Preliminary Economic Assessment

Erin published an initial Preliminary Economic Assessment (PEA) in September 2014. It highlighted a 21-year mine life producing 14,100tpa of contained B_2O_3 with start-up capex of US$85M, a post-tax NPV (10%) of US$428M, an IRR of 64% and a payback of 1.25 years.

In June 2022, Erin published the results of a new PEA, with improved economics. The revisions include a 16-year mine life, annual production of 258,272t of sales grade colemanite and 25,000t of boric acid, initial capital costs of US$80M (including a 30% contingency), a post-tax NPV (10%) of US$525M, a post-tax IRR of 79% and a 12-month payback.

The June 2022 Piskanja Preliminary Economic Assessment

Economics of the PEA

The key points from the Preliminary Economic Assessment (PEA) are that the project has a post-tax NPV (at the 10% base case discount rate) of US$524.9M, a post-tax IRR of 78.7% and a 12-month capex payback from start-up. Initial capital costs for the 16-year mine life are estimated at US$79.9M (including a 30% contingency) and the mine is expected to produce an average of 258,272tpa of sales grade colemanite and 25,000tpa of boric acid. We understand that the economic analysis in the PEA is based on H1 2022 US$ in real terms and assumes that construction starts in 2024, with first ore being processed in 2026. It is assumed that the construction of the boric acid plant starts in 2029, with first production in 2031. The assumption is that production ceases in 2042.

Figure 16: Piskanja project PEA highlights

Post-tax NPV (10%)	US$524.9M
Post-tax IRR	78.7%
Initial capex (including 30% contingency)	US$79.9M
Capex payback from start-up	12 months
Life-of-mine (LOM)	16 years
Gross project revenue	US$2.02bn
Net project cashflow (post-tax)	US$1.21bn
Average annual gross revenue	US$126.0M
LOM average annual EBITDA	US$91.3M
Net operating margin	72.4%
Post-tax operating cost/t product	US$167.45
Weighted average revenue/t product	US$514.02
LOM sustaining capex (including 30% contingency)	US$50.8M
LOM averge gross production	305,304t
Post-tax Profitability Index (NPV/ Initial Capex)	6.57x
LOM Capital Intensity Index (Initial Capex/ROM tonnage)	US$16.36
LOM average C1 (cash operating) cost (ROM production)	US$91.95/t
Average annual production (sales grade)	258,272t colemanite
Average annual production	25,000t boric acid
LOM average C1 cost (colemanite)	US$154.50/t
LOM average C1 cost (boric acid)	US$340.70/t
LOM AISC (sales grade)	US$122.19/t
LOM mining production	4.88Mt
LOM cut-off grade/average mineral body thickness	12% B_2O_3/1.2m
LOM average grade (measured, indicated and inferred)	34.57% B_2O_3
Good potential for resource expansion	

Source: Erin Ventures' June 2022 PEA

The base case economics for the PEA were undertaken using a flat US$500/t price for colemanite and US$700/t for boric acid. The boric acid price assumption is lower than that used by 5E Advanced Materials and Ioneer in their respective Fort Cady (US$750/t) and Rhyolite Ridge (US$710/t) feasibility studies. The PEA identified total project gross revenue of c.US$2.02bn, and net project cashflow of US$1.21bn (post-tax).

Figure 17: Piskanja total project revenues and cashflows

Project cashflow	US$M
Gross revenue	**2,017**
Deductions	107
Net revenue	**1,910**
Operating costs	449
Project capital	80
Sustaining capital	51
Closure	15
Project cashflow	**1,315**
Working capital	0
Corporation tax	101
Net project cashflow (post-tax)	**1,214**

Source: Erin Ventures' June 2022 PEA

Sensitivities

In the PEA, a number of sensitivities were undertaken. Turning first to the discount rate, the base case model in the PEA uses a 10% discount rate, and yields pre-and post-tax NPV's of US$553.9M and US$524.9M. Pre-and post-tax rates have been calculated at discount rates varying between 5% and 15%, yielding a pre-tax NPV ranging between US$385.5M and US$831.1M, and a post-tax NPV ranging between U$369.0M and US$778.0M. It is worth noting that most peer projects use a lower, 8%, discount rate than the 10% base case used by Erin. An 8% discount rate increases the post-tax NPV of Piskanja by 16% to US$611.0M.

Figure 18: Piskanja project NPV at different discount rates

Discount rate	Pre-tax (US$M)	Post-tax (US$M)
5%	831.1	778.0
8%	647.8	611.0
10% (base case)	553.9	524.9
12%	476.9	453.9
15%	385.5	369.0

Source: Erin Ventures' June 2022 PEA

The PEA also illustrates the impact on the NPV (at the base case discount rate of 10%) of positive and negative changes of 10%, 20%, 30%, 40% and 50% to revenue, operating and capital costs, and colemanite and boric acid prices. The greatest sensitivity is to revenue, and colemanite prices in particular. The base case commodity prices used in the June 2022 PEA are US$500/t for colemanite and US$700/t for boric acid on a flat-line basis.

Figure 19: Piskanja project NPV sensitivities (at 10% base case discount rate)

	-50%	-40%	-30%	-20%	-10%	0%	10%	20%	30%	40%	50%
Revenue	121	201	282	363	444	525	606	687	767	848	929
Operating costs	616	598	580	561	543	525	507	488	470	452	434
Capital expenditure	562	555	547	540	532	525	517	510	503	495	488
Colemanite price	148	223	299	374	450	525	600	676	751	826	902
Boric acid price	497	503	508	514	519	525	530	536	541	547	552

Source: Erin Ventures' June 2022 PEA

The PEA also includes detailed sensitivities to operating costs and capital expenditure as well as a revenue/operating cost matrix.

Figure 20: Piskanja project operating cost and capital expenditure NPV sensitivities (US$M)

		Operating costs										
		-50%	-40%	-30%	-20%	-10%	0%	10%	20%	30%	40%	50%
Capital expenditure	-50%	653	635	617	599	580	562	544	526	507	489	471
	-40%	646	628	609	591	573	555	536	518	500	482	463
	-30%	638	620	602	584	565	547	529	511	492	474	456
	-20%	631	613	594	576	558	540	522	503	485	467	449
	-10%	624	605	587	569	551	532	514	496	478	459	441
	0%	616	598	580	561	543	525	507	488	470	452	434
	10%	609	590	572	554	536	517	499	481	463	445	426
	20%	601	583	565	547	528	510	492	474	455	437	419
	30%	594	576	557	539	521	503	484	466	448	430	411
	40%	586	568	550	532	513	495	477	459	440	422	404
	50%	579	561	542	524	506	488	470	451	433	415	397

Source: Erin Ventures' June 2022 PEA

Figure 21: Piskanja project revenue and operating cost NPV sensitivities (US$M)

		Revenue										
		-50%	-40%	-30%	-20%	-10%	0%	10%	20%	30%	40%	50%
Operating cost	-50%	212	293	374	454	535	616	697	778	859	940	1,020
	-40%	194	274	355	436	517	598	679	760	840	921	1,002
	-30%	175	256	337	418	499	580	660	741	822	903	984
	-20%	157	238	319	400	481	561	642	723	804	885	966
	-10%	139	220	301	381	462	543	624	705	786	867	947
	0%	121	201	282	363	444	525	606	687	767	848	929
	10%	102	183	264	345	426	507	588	668	749	830	911
	20%	84	165	246	327	408	488	569	650	731	812	893
	30%	66	147	228	308	389	470	551	632	713	794	874
	40%	47	128	209	290	371	452	533	614	695	775	856
	50%	29	110	191	272	353	434	515	595	676	757	838

Source: Erin Ventures' June 2022 PEA

Mining

The PEA envisages run-of-mine (ROM) production averaging 307,956tpa over a 16-year life of operation for annual production averaging 258,272t of sales-grade colemanite and 25,000t of boric acid (H_3BO_3). It is assumed that 44,000t of colemanite is used by the boric acid plant from Year 6, with the balance continuing to be sold as colemanite ore.The project is planning a 75% overall mining recovery.

The depth and geometry of the boron mineralisation means that the deposit lends itself to underground mining, with cut-and-fill the preferred mining method. Current plans envisage twin access declines from surface, with the main haulage decline (MHD) going from surface to the floor of Orebody 1, and the main ventilation decline (MVD) going from surface to the roof of Orebody 3. An underground spiral ramp will connect the MHD and MVD, giving access to all levels. A shaft will connect the

MHD and MVD serving as an ore pass and a temporary ore stockpile (if needed). Footwall drives will be located below all three orebody seams and level drives and ventilation connections will be installed between the 3 footwall drives.

For excavation, Erin currently plans mechanical cutting using continuous miners (CM) rather than drill-and-blast. This is required to minimise ground vibrations, which could damage housing and other buildings in the village of Korlace, which lies immediately above the planned mine. The company has also excluded mining methods such as caving, which could cause ground subsidence. Material mined by the CMs will be hauled by shuttles or battery haulers to the nearest ore pass/ore bin, and fed to panel conveyors on the main haulage horizon to the main ore pass/ore bunker, from where the material is fed via the main belt conveyor to surface, ready for stockpiling and processing. Waste material will be backfilled underground, adding additional stability underground, while also helping to reduce the risk of ground subsidence and minimising the surface environmental impact.

Processing

Erin plans for all ROM production to be fed to the colemanite plant to produce colemanite that can then be upgraded to boron trioxide (B_2O_3). The plan is for a boron product grade of 40% B_2O_3 and a tails grade of 7.5% B_2O_3. While current plans are for the production of c.250,000tpa of saleable colemanite and 25,000tpa of boric acid, further metallurgical testwork is required to confirm the feasibility of the proposed processing route, illustrated below.

The PEA notes that "No technically feasible process route has yet been demonstrated that can upgrade the Piskanja ore to what is considered to represent a minimum marketable concentrate grade. However, the process of B_2O_3 ore beneficiation does exist and is widely used in Turkish boron mines." Given the experience of Eti Maden in Turkey, it should therefore be feasible to upgrade the colemanite economically. The PEA says that according to available data from Turkey colemanite ores are concentrated through disintegration (crushing and tumbling), washing and then screening to produce different size fractions. Larger size fractions are separated via attrition tumbling and hand-sorting, while finer fractions (<6mm) are separated out by attrition scrubbing and classification. Eti Maden's Emet colemanite concentration plant has a capacity of 600,000tpa colemanite ore of 27% B_2O_3 and produces 300,000tpa of concentrate grading 43% B_2O_3.

Boric acid production is a well-documented process used by a number of producers globally. A typical flow sheet is shown in the following diagram.

Figure 22: Project capital cost estimates over the 24-month development period (US$M)

	Base cost	Contingency	Total
Mining	39.4	11.8	51.2
Processing - concentrate	2.0	0.6	2.6
Processing - boric acid	0.0	0.0	0.0
Infrastructure	16.3	4.9	21.2
Tailings	3.8	1.1	5.0
Total	**61.5**	**18.4**	**79.9**

Source: Erin Ventures' June 2022 PEA

Capital and operating costs

The PEA estimates total initial capital costs of US$79.9M comprising forecast base costs of US$61.5M and a 30% contingency of US$18.4M. The bulk of the capital costs (US$51.2M including contingency) are for mining with a further US$21.2M (including contingency) for infrastructure. The forecast cost to build the boric acid plant, US$19.5M (including 30% contingency), is excluded from the start-up capital expenditure total of US$79.9M, because it is assumed that this will be financed from cashflow later in the life of the mine. Likewise, a closure plan has still to be prepared for the EIA, and the PEA consultants

suggest a provisional ballpark estimate for closure of US$15M. Given that Erin does not yet have a technically viable processing route outlined, in our view the greatest risk to capital costs is that processing costs will be higher than currently envisaged.

In terms of unit operating costs, the PEA estimates total colemanite concentrate costs of US$154.5/t, and boric acid unit operating costs of US$340.7/t. For colemanite, the biggest operating cost component is expected to be mining (US$70.8/t) while for boric acid, it is the boric acid processing costs (US$205.8/t).

Figure 23: Project unit operating cost estimates (US$/t)

	Colemanite	Boric acid
Mining	70.8	0.0
Processing - colemanite	3.6	6.4
Processing - boric acid plant	1.7	205.8
Tailings/waste disposal	0.1	0.5
Infrastructure	4.3	6.4
G & A	23.5	34.6
Royalty	25.0	35.0
Sales & marketing	1.5	1.5
Tax	23.9	50.4
Total unit operating cost/t production	**154.5**	**340.7**

Source: Erin Ventures June 2022 PEA

Recommendations and next steps

In the PEA, the independent consultants' have recommended four key areas of work:

- Expand and improve the existing Piskanja mineral resource estimate through further exploration in the two unbounded directions (W and SW);
- Improve and refine metallurgical processes and recoveries theough further metallurgical testwork;
- Continue the evaluation of different production rates ("right-sizing") and optimisation of mine plans;
- Evaluate and incorporate existing technologies to improve sustainability and reduce the environmental impact.

Review of Serbian boron exploration/development peers

Rio Tinto (LSE/ASX:RIO, £50.98/A$102.70, mkt.cap. £82.9bn/ A$167.1bn)

As one of the world's largest mining companies, Rio Tinto is hardly a peer for Erin, but at its Jadar project in Serbia the company possesses the largest undeveloped boron project in the world. The company is already the world's second largest boron producer, with output of 488,000t of borates (B_2O_3 content) in 2021 from the Mojave Desert in California. The company recently (December 2021) announced the acquisition of the Rincon Mining salar lithium project in Argentina for US$825M, possibly as a result of the challenges to development that it currently faces at Jadar. In July 2021 Rio committed to spend US$2.4bn on Jadar to develop a long life (c.40 years) underground mining project in the lowest quartile of the cost curve. Construction had been expected to commence in 2022, with saleable production starting in 2027, ramping up to full capacity in 2029 of c.58,000tpa Li_2CO_3, 160,000tpa boric acid (B_2O_3 units) and 255,000tpa of sodium sulphate. The project has a mineral resource of 139.2Mt grading 1.78% Li_2O and 14.7% B_2O_3. The project was expected to contribute 1% to Serbia's direct and 4% to indirect GDP, and create c.2,100 jobs during construction and 1,000 ongoing jobs whem operational. In February 2022, the Serbian government revoked Rio Tinto's project licences (see page 17) so the future of the project is unclear, though we anticipate that a suitable compromise will be reached.

Euro Lithium (private)

Euro Lithium is a private company based in Vancouver. It has identified the Valjevo lithium-boron deposit, and has completed a mineral resource statement and a Preliminary Economic Assessment (PEA). The overall resource contains 2.3bn t with a total contained 9.6Mt Li_2CO_3 and 44.4Mt B_2O_3. The Mining Target Area is 116Mt with average grades of 0.44% Li_2CO_3 and 10.74% B_2O_3. The Scoping Study (Addendum 2) indicates a 40-year mine life, a post-tax NPV of US$1.54bn and a 33.4% IRR with a payback of 2.9 years. In 2020, the company was estimating that production might commence in 2025 for a starter project or 2027 for the full-scale operation. Euro Lithium also stated that it had identified a high-grade borax zone that could allow for the quick development of a low capex small borax operation. According to the company Valjevo is the 5th largest lithium deposit, 2nd largest borate deposit and largest lithium-borate deposit known globally and the 4th major lithium-borate discovery in history.

Balkan Mining and Minerals (ASX:BMM, A$0.165, mkt.cap. A$7.6M)

BMM was created in 2021 as a spin-off from Jadar Resources, now called EV Resources (ASX:EVR). The move was to allow EV to retain a stake in its Serbian lithium-boron projects, but allow it to focus more directly on its portfolio of base metals and lithium assets in Australia, the USA, Austria and Latin America. EV and Sandfire Resources (ASX: SFR) both have a 22% shareholding in BMM (Sandfire bought an A$2m cornerstone investment in BMM in the IPO). BMM has 3 projects in Serbia, with a total land package of 336km^2. These include the flagship Rekovac project, and the Dobrinja and Pranjani licences. Surface mapping, reconnaissance drilling and gravity and airborne magnetic surveys have been undertaken at Rekovac. The other two projects are even earlier stage. Some surface sampling has been undertakren at Dobrinja.

Volt Resources (ASX:VRC, A$0.017, mkt.cap. A$54.5M)

Volt Resources is progressing development of the Bunyu graphite project in Tanzania, and is also involved in gold exploration in Guinea. In July 2021 the company completed the acquisition of a 70% interest in the Zavalievsky graphite business in the Ukraine, an established miner and processor of graphite. In November 2021, Volt announced plans to acquire Asena Investments d.o.o., which holds the rights to three lithium-borate licences in Serbia – Jadar North, Petlovaca and Ljig. Jadar North lies immediately to the north of Rio Tinto's Jadar licences, and Jadar and Jadar North (area of 98.75km^2) cover the whole Jadar Basin. Four historical drill intersections encountered lithium and borate mineralisation. Petlovaca covers 99.65km^2 and lies north of Jadar North and is undrilled, while Ljig (92.31km^2), which lies close to Euro Lithium's Valjevo project, has had two

holes drilled, with indications of mineralisation found only as pseudomorphs (a crystal consisting of one mineral but having the crystal structure of another).

Temas Resources (CSE:TMAS, C$0.095, mkt.cap. C$6.7M)

Of course, one obvious peer is Erin's JV partner, Temas Resources. The two companies will each have a 50% stake in Piskanja if Temas completes its €10.5M investment in the project. Together with the payment of 250,000 Temas share and 250,000 stock warrants, Temas will have paid c. C$14.2M, and this is a negative relative to a comparable valuation of Erin. Temas is trying to present itself as an eco-friendly company investing in a number of technology or "green" commodities. Its other 3 investments are a 50% stake in ORF Technologies (which is looking to develop environmentally friendly processing technology for Fe-Ti-V, Ni-Co-PGM and non-cyanide Au recovery), MetaLeach ™ (exclusive licence for North America and Europe ammonia leaching technology) and the La Blanche Fe-Ti-V property (which has a historical resource and hopes to use ORF Technologies' technology). A number of juniors are developing portfolios of critical materials assets and Temas' portfolio doesn't appear to have any particular key advantages over others. For choice, we believe that investors who understand and believe in the potential upside in boron, would prefer a pure-play boron stock (and in this regard, Erin is unique).

Other boron exploration/development peers

5E Advanced Materials (ASX:5EA/NASDAQ:FEAM, A$1.835/US$12.19, mkt.cap. A$816.4M /US$542.3M)

5E Advanced Materials (formerly known as American Pacific Borates), is listed in Australia and also recently obtained a NASDAQ listing in the US. The company claims that its Fort Cady project in California is the largest known new conventional boron deposit in the world. The project has a mineral resource of c.327M short tons (296.2Mt) grading 8.22% H_3BO_3 (4.63% B_2O_3) and containing 13.7Mt of boric acid (B_2O_3). The deposit also grades 0.17% $Li_{2C}O_3$ for a contained 23,300t Li_2CO_3 which will be recovered along with SOP (sulphate of potash) and gypsum. Initial production from a trial small-scale boron facility is anticipated in 2022. At full capacity Fort Cady will produce 400,000+stpa H_3BO_3. 5E announced updates on its enhanced Definitive Feasibility Study (DFS) in February 2021, and a new mine plan and revised resource estimate (as outlined above) in November 2021. The company's plans for Fort Cady have evolved over the last four years, since the initial DFS was published in December 2018.

The updated enhanced DFS, published in February 2021, highlighted a 3-stage phased development (the first phase itself also comprising of 3 stages). Phase 1 was planned to produce 90,000 short tons (st) boric acid and 80,000 st of SOP annually, while Phases 2 and 3, identical in size, would take total production to 450,000 stpa boric acid and 400,000 stpa SOP. Total capital expenditure was forecast at US$843M, with an IRR of US$2.02bn and a 40.6% IRR.

In May 2021, the company said that it would defer Phase 1A (9,000 stpa boric acid and 20,000 stpa SOP) to focus on a larger borate operation and enhance its (now completed) US listing. Two options were under consideration. Option 1 called for the combination of all three Phase 1 operations into a 90,000 stpa boric acid and 80,000 stpa SOP production, while Option 2 called for combining Options 1 and 2 to deliver annual production of 270,000stpa boric acid and 240,000stpa SOP.

The changes in November 2021 follow the decision to reduce the cut-off grade from 5% B_2O_3 to 0% B_2O_3. The new mine plan calls for mining the entirety of the orebody, with a 38% increase in the head-grade assumption from 3.7% to 5.1% H_3BO_3 and the extraction ratio has been raised from 70% to 80%. The move follows the announcement of an 85% increase in the measured and indicated resource categories and the company now believes that in total it will be able to produce over 2.5 times the amount of boron envisaged in the enhanced DFS. An updated BFS is scheduled for completion in Q2 2022.

The company also holds the Salt Wells borate and lithium project in Nevada. The project covers an area of 36km^2 with surface sampling in the Northern area recording up to 810 ppm lithium and over 1% boron (over 5.2% boric acid equivalent). Limited exploration has been undertaken.

Ioneer (ASX:INR, A$0.41, mkt.cap. A$857.4M)

One of the most advanced independent boron projects (ie not associated with Eti Maden or Rio Tinto) is Ioneer's Rhyolite Ridge lithium-boron project in Nevada, located 25km west of Albemarle's Silver Peak lithium mine. The deposit contains a total mineral resource of 146.5Mt grading 0.9% Li_2CO_3 (equivalent) and 8.1% H_3BO_3 (equivalent) and containing 1.25Mt Li_2CO_3 (equivalent) and 11.89Mt H_3BO_3 (equivalent).

A bankable DFS was completed in April 2020 and the project is fully funded to a Final Investment Decision. The company expects the project to be construction-ready by Q4 2022 – over half of the detailed engineering has been completed. The company anticipates commencing production in late 2024, at an annual production rate of 20,600t of Li_2CO_3, 22,000t of lithium hydroxide and 174,400tpa of boric acid over a 26-year mine life. Given the production of lithium and boron, the company expects to be near the bottom of the lithium cost curve. Capital costs are estimated at US$785M and the company has reported an after-tax NPV (8%) of US$1,265M, IRR of 20.8% and a 5.2-year payback. In September 2021, the company announced that it was selling a 50% interest in the project to Sibanye-Stillwater for US$490M.

Ganfeng Lithium (HK:1772, HK$86.25, mkt.cap. HK$221.3bn)

Ganfeng is one of the world's largest lithium producers, and in January 2022 it took over Bacanora Lithium. While Bacanora's key asset is the Sonora lithium project in Mexico, Bacanora also held certain borate assets in the Magdalena Basin Project in Sonora, Mexico as well. Ganfeng has been on a buying spree for non-Chinese lithium assets, and it is unclear whether the company will retain the borate project. Bacanora undertook a Preliminary Economic Assessment on the El Cajon deposit in the Magdalena Basin Project in January 2013, which was amended in April 2016. An indicated resource of 11.0Mt averaging 10.6% B_2O_3 was identified. The key mineral is colemanite. The PEA outlines a 25-year project producing 50,000tpa of colemanite concentrate (42% B_2O_3) with an NPV (8%) of US$113M, a 24.8% IRR and a 4-year payback.

Comparing Erin's Piskanja project with its peers

There are a limited number of peer projects and boron explorers/developers available to compare against Piskanja, making Erin a unique single asset pure play boron explorer/developer. Rio Tinto is a huge diversified mining company, while Ganfeng and producer Allkem are predominantly lithium companies. In Serbia, Euro Lithium is a private company, while Balkan Mining and Minerals and Volt Resources are at an early stage of exploration, and do not have mineral resources yet, let alone a PEA. The two most relevant peers are probably 5E Advanced Materials and Ioneer, although both companies operate in California/Nevada rather than Serbia, both intend to produce lithium as well as boron, both companies are at a more advanced stage than Erin, and both have definitive or bankable feasibility studies on their projects. 5E's Fort Cady project and Ioneer's Rhyolite Ridge project contain a substantially higher tonnage of mineral resource than Erin's Piskanja project, but are also significantly lower grade. Indeed, Piskanja is significantly higher grade than all of its peer development projects, containing more than double the contained B_2O_3 grade of Rio Tinto's Jadar project.

Figure 24: Boron development projects – total mineral resource

Company	Deposit	Location	Resource Date	Resource (Mt)	Grade % B_2O_3	Grade % Li_2O	Contained B_2O_3 Mt	Contained Li_2O Mt
Rio Tinto	Jadar	Serbia	Dec-20	139.2	14.7	1.78	20.5	2.5
5E Advanced Materials	Fort Cady	California	Nov-21	296.2	4.63	0.17%Li_2CO_3	13.7	0.5
Ioneer	Rhyolite Ridge	Nevada	Apr-20	146.5	1.42% B	0.16% Li	2.1B	0.2 Li
Euro Lithium	Valjevo	Serbia	Mar-20	1,696	1.98	0.17	33.6	2.9
Ganfeng Lithium	El Cajon	Mexico	Apr-16	11	10.6		1.2	
Erin Ventures/Temas Resources	Piskanja	Serbia	Jun-22	7.2	34.6		2.5	

Source: Company websites. 5E resource is in metric tonnes converted from the SEC S-K 1300 and Uncontrolled Mineral Resource estimate. Rio Tinto and Ioneer are JORC, the others are based on NI 43-101 methodology

Turning to the economics of the potential development projects, Rio Tinto's Jadar project is the most significant in terms of mine life, capital expenditure and total equivalent production, but the company has not provided any NPV, IRR or payback data. With the exception of Ganfeng's small El Cajon project, the data of which is from an old 2016 PEA, Erin's Piskanja project has the lowest capex (at US$80M), the highest post-tax IRR at 79% and the shortest payback period (12 months). This is using the base case discount rate of 10% from the June 2022 PEA. At an 8% discount rate, as used by its peers, the IRR would be even more attractive and the payback period would be under a year. Based on the findings in the PEA, Piskanja should be a highly profitable project.

Figure 25: Boron development projects – key statistics

Company	Project	Status	Latest Study Date	Mine Life (yrs.)	Average Annual Production (t)	Start-up	Capex US$M	Post-Tax NPV (8%) US$M	Post-Tax IRR %	Post-Tax Payback Period Years
Rio Tinto	Jadar	Permits revoked	Dec-20	40	58,000t Li_2CO_3 160,000t B_2O_3 255,000t Na_2SO_4	2027	2,400	not available	not available	not available
5E Advanced Materials	Fort Cady	Enhanced DFS	Feb-21	21	408,000t H_3BO_3 363,000t SOP	Q3 21	843	2,020	41	1.9
Ioneer	Rhyolite Ridge	BFS	Apr-20	26+	22,340t Li_2CO_3 (yr 1-3) 21,951t LiOH (yr 4-26) 174,378t H_3BO_3	2023	785	1,265	20.8	5.2
Euro Lithium Phase 1	Valjevo	PEA	Mar-20	6	21,000t Li_2CO_3 542,000t H_3BO_3	2025	437	4,000 (Phases 1&2)	20.6 (Phases 1&2)	5.3
Euro Lithium Phase 2				25	72,000t Li_2CO_3 1,032,000 H_3BO_3	2031	1,085			1.7
Ganfeng Lithium	El Cajon	PEA	Apr-16	25	50,000t colemanite concentrate		7.25	113 (1)	24.8 (1)	4
Erin Ventures/Temas Resources	Piskanja	PEA	Jun-22	20	258,272t colemanite, 25,000t H_3BO_3	2027e	80	525 (10%)	79	1

Source: Company websites

MMG Capital's Potential Indicative Valuation of Erin Ventures

Cautionary note

As a TSXV-listed company, Erin Ventures adheres to criteria set out by the National Instrument 43-101 (NI 43-101) which is Canada's national instrument for the standards of disclosure for mineral projects. The Instrument is a codified set of rules and guidelines for reporting and displaying information related to mineral properties owned by, or explored by, companies which report these results on stock exchanges within Canada. NI 43-101 guidelines are similar to those of JORC and a number of other similar codes around the world, and oversee the preparation of Technical Reports that cover mineral resources and ore reserves, Preliminary Economic Assessments, Pre-feasibility Studies and Feasibility Studies.

Whilst Erin has a mineral resource and has just published a new Preliminary Economic Assement there is still considerable risk to the project (as can be seen by the 30% capital cost contingency in the PEA capital cost estimate), and no guarantee that Erin can obtain a mining licence and develop an economically-viable boron mine at Piskanja.The recent release of the new PEA does, however, provide some confidence here. Potential investors should, however, be aware that pre-production mining companies carry considerable investment risk and you may lose some or all of the money that you invest in Erin.

Valuing Erin Ventures – a sum-of-the-parts approach

The recent May 2022 Preliminary Economic Assessment (PEA) provides a good basis for valuing Piskanja and therefore Erin. Given how recent the PEA is, , we see no need to rework or remodel with other assumptions. Half of the NPV of Piskanja (ie Erin's 50%) is US$262M or C$338M. We have discounted this by 50% to take account of country and project risk. This is an arbitrary discount, but takes into account the lack of recent mine developments in Serbia, and the challenges that Rio Tinto has recently faced at its Jadar lithium-boron project. We have then adjusted for Erin's 50% share of capital costs (less the additional €10.5M contribution from Temas), added net cash/cash equivalents, and removed 3 years' worth of operating activities and exploration costs. We have not included any value for the Jarandol licence. This leaves a value for Erin of $C 122.3M or C$0.79/share, which is clearly significantly higher than the current share price of C$0.085.

One other way to look at this is simply to value Erin against the Piskanja project. Erin's 50% of post-tax NPV (10%), after a 50% discount for development risk and development capex, is worth C$124.9M, while the company has a market capitalisation of C$13.1M. So Erin is trading on a 0.1x market capitalisation/NPV ratio. Looking at EV/EBITDA, Erin's current enterprise value is C$10.7M, and the average annual EBITDA from Piskanja is C$45.7M (50% basis), yielding an EV/EBITDA ratio of 0.28x. That looks cheap relative to a number of other critical raw materials' explorers/developers.

For illustrative purposes only, let's look at Savannah Resources, an AIM-listed company based in the UK and hoping to develop its wholly-owned Barroso lithium project in Portugal. This example is of course in a different country, with a different commodity and a project at a more advanced stage; the mining lease granted in 2006 and the Scoping Study (the JORC equivalent of a PEA) completed in 2018. In the presentation that Savannah gave at its recent AGM (8th June 2022), the company quoted a post-tax NPV (8%)/market capitalisation ratio of 0.4x and an EV/EBITDA ratio of 1.0x. So Savannah is currently trading on an NPV ratio that is c.4X higher than Erin, and an EV/EBITDA ratio that is c.3.6x higher, whilst using a lower discount rate. And if we remove the 50% development discount that we applied to Erin, the Savannah ratios are c.9x and c.8x higher than for Erin.

Figure 26: Valuing Erin Ventures

Item	US$M	Attributable to Erin C$M
Post-tax NPV (10) of Piskanja 100%, June 22 PEA	524.9	
Post-tax NPV (10) of Piskanja 50%, June 22 PEA		338.6
50% chance of development - discount for country and project risk		169.3
Piskanja capital costs	79.9	
Temas option share of capital costs (€10.5M at 1.047 US$/€)	11.0	
Erin 50% share of remaining capex		-44.4
Net cash & cash equivalents (31st March 2022)		0.1
Less 3 years of 9M to 31/03/22 cash used in operating activities & exploration		-2.6
Implied valuation of Erin		**122.3**
Erin shares in issue - 153.87M		
Valuation per share		**0.79**
Current share price		**0.085**
Current C$/US$ exchange rate	1.29	
Current US$/€ exchange rate	1.047	

Source: MMG Capital

Directors, Management and Financial Position

Board of Directors

Tim Daniels – President and Director – Tim has over 15 years'experience in the development and financing of natural resource and industrial companies and prior to that was a Branch Manager for a Canadian Investment Dealer where he acquired extrensive knowledge in corporate and equity financing as well as general business development. He has been a director of Erin since 1996.

Jim Wallis –Director and Manager of Mining Operations – Jim has 30 years of experience in all stages of mineral exploration and mine development and has worked worldwide for companies like Noranda (through various takeovers, now part of Glencore), Kerr Addison, US Borax (part of Rio Tinto) and Amax. He has been based in Belgrade, Serbia, since 1996, was was appointed a Director of Erin in 2014.

Vladan Milosevic – Director – Dr Milosevic has held the position of Department Chief for Mineral Processing at Belgrade's Institute for Technology of Nuclear and Other Mineral Raw Materials since 1997. He has been Project Manager for a number of Serbian mineral processing projects operated by RTB Bor including the reconstruction and expansion of the Veliki Krivelj copper flotation facility, the increase in recoveries at the Cerovo Cementacija 1-South deposit and processing optimisation at the Tenka 3 orebody at the Majdanpek copper mine. He was appointed a Director of Erin in 2013.

Dusan Podunavec – Director – Dusan is a former General Manager of the Geological Survey of Serbia and was appointed a Director of Erin in 2019.

Key Management – the executive team

Blake Fallis – Chief Financial Officer and General Manager – Blake was appointed General Manager in 1998 and CFO in 2010. He has over 20 years' experience in financing and corporate development and has worked with a number of private and public companies providing corporate finance, investor relations and corporate development strategies. Blake also spent a number of years working as a stockbroker in Canada.

Financial Position

Erin's financial year end is June 30th. The company's last published financial results were for the quarter and nine months ending 31st March 2022. In the nine months ending 31st March 2022, the company spent C$655,000 on operating activities (primarily management fees and central costs) and investing activity (exploration and evalution), down from C$1,119,000 in the equivalent period of 2021. We anticipate that central and management costs will continue to run at C$200,000-250,000 per quarter. At the end of March 2022, the company had a cash position of C$145,407, and net cash and cash equivalents of C$92,538.

It is important to note that Piskanja development costs are being borne by Temas, up to a total work expenditure of €10.5M (equivalent to c.US$11.0M or C$14.2M), so Erin's near-term financing requirements are expected to continue to be primarily for central and management costs. At 31st March 2022 the company had a cash position of C$145,000, a convertible debenture of C$56,000 and a loan from Canada Emergency Business Account of C$40,000 (relating to COVID-19 support). The loan is non-interest bearing until the end of 2022 (and then 5%pa) and if C$30,000 is repaid by the end of 2022 the remaining C$10,000 will be forgiven.

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