Rio Tinto Serbia Highlights
Innovating to Develop New Resources

From the General Manager

As we move into the last quarter of the year, I am pleased to report that we continue to make steady headway at the Jadar site. Our field program is well underway and we are busy making detailed study plans for next year. These plans will consider the whole range of mining activities and related issues from underground development, geology and processing to our social and environmental impact assessment.

At this stage our priority is still to increase our knowledge of the ore body and understand in the greatest detail possible how our prospective project would operate. It’s a slow and steady business, but it all adds up to us being able to move forward with confidence in the work we have done so far. As the Serbian saying goes ‘measure three times and cut once.’

In an earlier edition of the newsletter we featured an article on borates. This edition features one on lithium, our other main product. I hope you find it interesting.

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Hydrogeological Studies Make Headway

The field team has been updating our hydrogeological database with new data collected this year. Drilling is ongoing at two locations within the ore body. Hydrogeological nests, each comprising of several piezometric holes will range in depth from 100 m to over 500 m. Piezometers will be installed in close proximity enabling water flow and water quality testing, which will improve our hydrogeological knowledge of the ore body.

The Facts About Lithium

Lithium: What it is, and where it’s found.

Lithium was first discovered by Johan Arfvedson in 1817 in Stockholm, Sweden when he was analyzing a sample of mineral petalite. And, petalite (LiAl(Si2O5)2), was first found by Brazilian scientist José Bonifácio in 1800. Arfvedson identified lithium, but never succeeded to fully isolate it. This took another several decades, when in 1855 the mineral was isolated by Swedish chemist William Brande. The first commercial production of lithium in 1923 is attributed to Metalgesellschaft AG, formerly one of Germany’s largest industrial conglomerates.1

Lithium is a soft metal, the lightest in the periodic table. It has a silvery white appearance, and reacts immediately with water and air. Lithium has the highest electrochemical potential of all metals, making it extremely well-suited to modern applications that are explored later in this issue. Lithium does not occur as a pure element in nature, rather it is contained within mineral deposits or salts, including brine lakes. The concentration of lithium in these sources is generally low, and only a limited number of sites exist where lithium can be economically extracted.2 The Jadar deposit in Serbia is potentially one of these unique locations.

High-grade lithium brines and ores currently supply all of the commercial lithium that is produced, and over the last half of the 20th century lithium production shifted from the pegmatite deposits found in the U.S., to the brines of South America.

1 http://www.mineralszone.com/minerals/lithium.html
2 Global Strategic Metals, The lithium market, Sept. 2013
High-Grade Lithium from Brine
When high-concentrations of lithium were discovered in the brines of the Salar de Atacama in Northern Chile, and later in Salar del Hombre Muerto in Argentina. These discoveries tilted the global supply of lithium towards South America. Several other lithium brine deposits were subsequently discovered in Bolivia, China and Tibet, and brines are now the main source of lithium in the world today. Lithium brines are found in salt lakes, or salars, where water leaches lithium from the surrounding rocks, and is later trapped and concentrated as the water evaporates.

High-Grade Lithium from Ore
Today, commercial lithium also comes from spodumene, a mineral that occurs in pegmatite belts around the world. Currently, lithium-producing ores are mainly found in Australia, Brazil, China, Portugal and Zimbabwe. Australia’s Greenbushes lithium operation is the largest hard rock, high-grade lithium resource in the world. Russia and Argentina have smaller lithium ore bodies. Both open pit and underground mining methods are used to extract lithium minerals.

Lithium Uses
Lithium has many uses, the most well-known of which are the batteries that power cell phones, laptop computers, and electric and hybrid vehicles. Many other uses are less well-known, but are no less important. Lithium is used to produce glasses and ceramics adding strength and temperature resistance. It is also used in heat-resistant greases and lubricants, and it is alloyed with aluminum and copper to save weight in airframe structural components.

Although lithium markets vary by location, The U.S. Geological Survey estimated in 2012 that the industrial end-uses of lithium globally broke down as follows: ceramics and glass, 35%; batteries, 29%; greases, 9%; air treatment, 5%; metallurgy, 6%; polymers, 5%; aluminum refining, 1%; and other uses, 10%.

Roskills, a leading industrial minerals research firm, predicts that lithium consumption could increase by more than 11% per year, with demand for battery-grade lithium leading the way in the future.

Industrial Consumption of Lithium Worldwide in 2012

4 USGS, 2014
Global Lithium

• Total global volume of lithium carbonate produced annually is 168 kt of Lithium Carbonate Equivalent (LCE). 5

• 60% of global lithium produced today comes from brines in Chile and Argentina.

• The supply of lithium is currently controlled by just four major producing companies: Chile (Salar de Atacama), Australia (Talison Lithium), China/Tibet (Lake Zabuye), Argentina (Salar del Hombre Muerto).

• Consumption of lithium exceeded 150 kt LCE in 2012.

• The prospect for new supply to come into the market is restraining price rises despite increasing demand for automotive and IT applications. 6

• Lithium demand is expected to swell through 2020, fueled by increases in hybrid and electric vehicle sales.

• For every unit of lithium in a cell phone battery, there 7 units in a computer battery, 3,000 in a hybrid car, and 7,000 in an electric car this means between 9-30 kg of Li2O per car battery.

DID YOU KNOW:

• There are about six billion cell phones in the world, almost as many phones as there are people, and most of these are powered by a lithium battery.

• Lithium is the lightest and most reactive of the alkali metals.

• Lithium never occurs as a pure element; it is always bound as a stable mineral or salt.

• Lithium is naturally present in many grains and vegetables.

• Lithium’s name derives from the Greek word ‘lithos’ meaning ‘stone.’

5 2013 Roskills Report, Lithium: Market Outlook to 2017
6 2013 Roskills Report, Lithium: Market Outlook to 2017
The Jadar region has extraordinarily rich archeological heritage. In the Paulje area of Brezjak Village where Rio Tinto Serbia is exploring, there are tombs from the Bronze and Iron ages.

The necropolis at Paulje is surrounded by farms on the western bank of the Korenita river, and consists of a number of tumuli or ancient burial mounds.

These barrows are cone-shaped and measure between 10 and 20 meters in diameter and 1 to 3 meters in height. Some are well-preserved, some less so.

Rio Tinto is supporting the Jadar Museum over a five-year period to excavate these tumuli and up to €50,000 will be donated. Since 2010 three tumuli have been excavated every year and archeologists have discovered bracelets, necklaces, spears, urns and other artifacts dating back thousands of years, which will now be conserved and exhibited in the museum.

Archaeologists are working closely with the Rio Tinto team, sharing information that will contribute to the Jadar cultural heritage survey, which is part of the project’s Environmental and Social Impact Assessment.