

# Rarer than rare earths, the trials and tribulations of tellurium

It seemed an apt moment for me to revisit Tellurium, a metal I have watched over the years and yet with which little has been done despite its high value and immense scarcity. While other specialty metals boomed and busted, Tellurium never left the runway in the first place despite its fortunes being intimately linked with those of the solar energy sector. However, unlike the other specialty metals where a hardy few have struggled out of the bunker after the nuclear winter, the Tellurium players have largely died of neglect. I shall look here at a few of the walking (and non-walking) wounded.

## Rarer than Rare Earths

In the minds of the public the metal mostly is heard of tangentially as having given its name to the Telluride Film Festival and the Telluride Bluegrass Festival, both of which take place at the Colorado town which optimistically was named in the hope that it could deliver telluride gold to its founders (which didn't eventuate). Tellurium is a chemical element, with the symbol Te, and atomic number 52. In refined form it is a brittle, mildly toxic, rare, silver-white metalloid which looks similar to tin, tellurium is chemically related to selenium and sulfur. It is occasionally found in native form, as elemental crystals.

With an abundance in the Earth's crust comparable to that of platinum, tellurium is one of the rarest stable solid elements in the Earth's crust. Its abundance is about 1  $\mu\text{g}/\text{kg}$ . In comparison, even the rarest of the lanthanides have crustal abundances of 500  $\mu\text{g}/\text{kg}$ .

Nor unsurprisingly, in light of the fact that Transylvania has

some of the best Tellurium deposits, it was discovered in the Austro-Hungarian Empire, in 1782 by Franz-Joseph Müller von Reichenstein in a mineral containing tellurium and gold. Martin Heinrich Klaproth named the new element in 1798 after the Latin goddess of the earth, Tellus. Tellurium was first discovered in the 18th century in a gold ore from the mines in Zlatna, near today's city of Sibiu, Romania.

Gold telluride minerals (hence the Colorado town's name) are the most notable natural gold compounds. However, they are not a commercially significant source of tellurium itself, which is normally extracted as a by-product of copper and lead production.

### **Joined at the Hip with Copper**

The principal source of tellurium is from anode sludges produced during the electrolytic refining of blister copper. It is a component of dusts from blast furnace refining of lead. Treatment of 500 tons of copper ore typically yields one pound (0.45 kg) of tellurium. Tellurium is produced mainly in the United States, Peru, Japan and Canada. For the year 2011 the USGS gave the following numbers: Russia 35 tonnes, Peru 30 tonnes, Japan 40 tonnes and Canada 10 tonnes. Its estimates global reserves at 24,000 tonnes of which the US has 3,500, Peru has 3,600 and Canada 800. Interestingly the US had been a producer in 2009 statistics from the BGS and had dropped out of the picture two years later.

### **Usage**

Commercially, the largest consumer of tellurium is metallurgy, where it is used in iron, copper and lead alloys. When added to stainless steel and copper it makes these metals more machinable. In lead it improves strength and durability and decreases the corrosive action of sulfuric acid.

Applications in solar panels and as a semiconductor material also consume a considerable fraction of tellurium production.

Cadmium telluride (CdTe) solar panels using this material achieve some of the highest efficiencies for solar cell electric power generation.



Pricing is good with the metal trading for over \$130 per kg (or \$130,000 per tonne for those who like big numbers). The price had been as high as \$300 per kg in 2008.



### **A Salutory Lesson?**

I had this story brought to our attention several years back when a coterie of denizens of the Yal Club in New York wanted me to “do something” about the dire management in place here. Unfortunately the management proved to be immovable and the disgruntled largest shareholder was not disgruntled enough to move himself to action. The rest is history.

Firstly one should not confuse this company (once listed on the TSX-V) with the far more successful company of similar name listed on the ASX. This Gryphon Gold is (was?) a US-based mine development company which had (has?) as its principal asset the 23.5 square mile Borealis property located in the Walker Lane gold belt of Western Nevada. The company was formed as a private entity in 2003. In December of 2005 Gryphon Gold was taken public and traded on the Toronto Stock Exchange and the OTCBB in the United States.

The reason we mention this company is that its Nevada mine is one of the few places in the world with the mineral nagyagite, otherwise known as black tellurium.

In June 2011 it began construction of the Borealis Oxide Heap Leach Mine. In rather short order (September 2011) it began the heap leaching process by dripping cyanide solution onto the first constructed heap.



The heap leach operation began gold production in March 2012 with the pouring of two doré bars from loaded carbon. During fiscal 2012, the Company sold 32 tons of loaded carbon containing approximately 1,580 gold ounces. In the first quarter of fiscal 2013, 3,280 gold equivalent ounces were sold from the ADR plant.

The company however came to grief and in the words of its website: "In an effort to address certain operational and liquidity challenges, Gryphon Gold Corporation has filed a voluntary petition under Chapter 11 of the United States Bankruptcy Code. The petition was filed in the United States Bankruptcy Court for the District of Nevada (Reno, Nevada) on July 29, 2013" This did not come as a surprise to the Yalies or myself but nevertheless represented an unfortunate step back in moving one of the best Tellurium prospects around towards commercial production and becoming a useful source of the metal.

### **In the Wilds of BC...**

Another one of Vancouver's walking wounded is Deer Horn Metals (DHM.v). We came to know this name back in balmier days when it was morphing from Golden Odyssey Mining Inc.. The name change happened in January 2011.

Its principal property is the Deer Horn property, a tellurium-gold-silver-tungsten project covering 6,056 hectares located in west-central British Columbia, approximately 36 kilometers south of the Huckleberry Mine. The high-grade gold, silver and tellurium zone which begins at surface.

In August 2009, the Golden Odyssey entered into an option agreement with Guardsmen Resources Inc. to acquire an initial 50% interest in the Deerhorn property, located in north western British Columbia. To acquire a 50% interest, Deer Horn was required to incur \$5mn in exploration expenditures which

it accomplished and then it may acquire an additional 25% interest by incurring all costs required to bring the property to commercial production.

Deer Horn got as far as publishing a PEA in March 2013 before it went into its current state of (shell-like) limbo. The PEA estimated an operation with average grades of:

- Gold 2.45 g/t
- Silver 77 g/t
- Tellurium 74ppm

It estimated total production of:

- Gold 67,000 ozs
- Silver 2,112,000 ozs
- Tellurium 63,000 kgs

Frankly the Tellurium looks like the most interesting part of the equation.

### **Other Mining Names to Conjure With**

As a subsidiary product, finding which companies may have Tellurium in their mix (and in relevant quantities) is not that easy. Our sleuthing around has thrown up Talga Resources (TLG.ax) with its Bullfinch deposit in Western Australia with readings of up to 107ppm of Te, and Mexivada Resources (MNV.v) with properties in Mexico and Nevada.

The former is interesting because it is in the general vicinity of the Kalgoorlie goldfields which have long been known for their Tellurium component in gold production. Mexivada, on the other hand, has what it calls the AuroTellurio property for Gold, Silver, and Tellurium, which is located near Moctezuma, northeast of Hermosillo, Sonora, adjacent to a high grade tellurium-gold-silver mine, the Mina La Bambolla. Mexivada owns 80% of the property, and 20% is owned by California Gold Corporation, which renewed an option

on the property. AuroTellurio was staked to surround the Bambolla Mine, a high-grade gold-tellurium prospect and former producing gold-silver-tellurium mine controlled by TelOro, which intriguingly, Mexivada believes to be a Mexican company offshoot from First Solar Corporation.

In neither case (Talga or Mexivada) though are the assets near production.

### **First Solar (FRLR:NASD) – Riding High on the Hog**

This company is a leading producer of solar panels. As can be noted it has had a rough ride going from flirting with \$180 per share, down to nearly \$10 and having staged a steady recovery to its current level just below \$80.



I shall not digress into First Solar's business model, but is it not telling that as this stock stages its resurrection from the dead, the explorers in the Tellurium space are scattered around like dead bodies with little hope of reactivation?

Was does this imply for the future of Tellurium supply to the solar panel industry? Does this not remind watchers of what happened in Rare Earths, Antimony and other specialty metals where a long period of no investment led to a major supply crunch?

### **Conclusion**

Jack Lifton always likes to have the last word so my conclusion is a good place to bring him into the picture. Back in the olden days (of 2009) when Jack was only known to the cognoscenti he was also one of the few prognosticating upon Tellurium. In an article he wrote at the time he questioned whether the solar panel industry would be able to get all the tellurium it wanted/needed due to the interdependency with the copper industry and its output. Of course solar went into a

swoon or both popularity and profitability from which it is now emerging. So it was a case of Apocalypse Delayed..

However, with recovery in train, the Tellurium mining space has not got any better and can be seen as a lot worse with several players run into the rocks, and sunk, and others dithering about wondering if the markets will ever fund them. Seems like a good moment for a serious Tellurium hunter to appear on the scene and make the space their own.