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## Dubbo could hold key for eudialyte deposits

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**A RENOWNED rare earths specialist believes work being undertaken by Alkane Resources on its Dubbo zirconia project in New South Wales could hold the key to treating the world's eudialyte deposits and open up a new source for heavy lanthanides (rare earth elements).**

In Perth recently at the special request of Artemis Resources, Dr Tony Mariano said the rare earths industry was paying close attention to the work being undertaken by Alkane at Dubbo.

"Alkane is getting their rare earths from a calcium zirconium silicate which is very much like eudialyte, but amenable to chemical processing," he said.

The problem with eudialyte (a sodium calcium zirconium silicate) has always been in its treatment.

To date, no effective method has been developed to remove the heavy earths such as yttrium and zirconium from the silica, but once that is achieved, Dr Mariano said it would become the best source for heavy lanthanides on a world level.

"Once this achieved, it to me [eudialyte] is the mineral for heavy rare earths and for solving the South China Clays problem," he said.

Rare earth metals are vital to the production of many high-tech products – including hybrid vehicles, mobile phones, computers, television and even smart missiles.

Alkane technical director Ian Chalmers told *Miningnews.net* the company had already cracked the code when it came to successfully treating its Dubbo ore, and was now busy turning it into a commercial reality.

"We understand the chemistry and science and have produced metal in solution," Chalmers said.

"Most people have difficulty understanding that our flowsheet and demonstration plant clearly shows that we are going from rock to finished high-quality end product.

"Because we have four metal streams at Dubbo – zirconium, niobium, light rare earths and a yttrium heavy rare earth – the actual cost of leaching the chemicals out of the rock is not that high and actually very efficient because we not putting deleterious material like silica back into solution."

The company has spent the last 14 years on research and development of a flow sheet at Dubbo and spent close to \$A12 million, \$3.3 million via a federal government grant.

A feasibility study is due to be handed down at the end of the year, but the base case scenario has already pointed to \$100 million per annum in revenue at costs of \$50-60 million a year.

The flow sheet consists of sulfuric acid leach followed by solvent extraction recovery and refining to recover a suite of zirconium chemicals.

"They are not unrealistic operating costs and there is quite a substantial premium built into that," Chalmers said.

"Nobody else has achieved that anywhere and obviously, there are components of the flowsheet we really don't say much about.

"We haven't got a patent on it and are actually looking at patenting some of it, but the trouble is, and this is a real issue of patents, that once this is done it becomes public information.

"So, the easiest way to protect the proprietary information is to not say too much about it."



Rare earth oxides

The past 18 months has all been about marketing for Alkane, as it pushes home the message that it is an alternate supplier to China.

"We are now sending product from the demonstration plant at Lucas Heights around the world and talking to end users to ascertain demand and prices they are willing to pay, and we will feed that back into the FS," Chalmers said.

"Some of the offtake people we have been talking to have an interest in investing in the project, so it is possible that when it comes to the crunch of building the plant (which has been estimated to cost \$50 million), we might have one or up to three partners get involved.

"We are talking to people about that possibility but nothing has been finalised."

Dubbo has resources of 73.2 million tonnes grading 1.965 zirconium, 0.46% niobium, 0.14% yttrium and 0.75% rare earth oxides, or sufficient open pit material to sustain a 200 year mine life.

At the end of the day, Chalmers said the rare earths industry was a complex business.

"Some of the chemistry is amazing," he said.

"For example, one of the heavy minerals ytterbium takes 1000 stages of solvent extraction separation before ytterbium metal can be produced, now that is simply huge."

In looking at the rare earths industry in more detail, Dr Mariano said the major sources in history were from mineral bastnasites, a rare earth carbonate which is derived almost exclusively from carbonatites.

Other forms include monazite, which has been mined from beach sands as a by-product from other types of mining; xenotime, which is derived from the same source; loparite, a derivative of a calcium titanium silicate, ion-adsorbed rare earth elements and yttrium in clays like those found at South China Clays; and uraninite, which will host small quantities of substitutional heavy rare earths.

"That mineral (loparite) can contain a lot of rare earths substituting for the calcium and it can have niobium and tantalum substituting for the titanium," Dr Mariano explained.

"The Russians mined this for many years as their major source of rare earths niobium and tantalum, but in the western world, including Australia, I don't think we could afford to mine it, but I believe the Russians are back mining it on a small scale."

As for uraninite, once that is put into solution with sulfuric acid the fluids that result are called raffinates and it is these that contain the heavy rare earths in solution which can be easily removed.

"This can occur anywhere where uraninite is mined such as the Athabasca Basin in Canada," he said.

At one stage Australia provided 25-30% of the world's rare earths from monazite it exported from mineral sands, and in the late 1970s a rare earth concentrate was also produced from the Mary Kathleen mine in the Northern Territory.

The source of the rare earths at Mary Kathleen was the mineral allanite.

However, Dr Mariano said the key to a successful rare earths operation was the chemical cracking of the individual lanthanides (rare earth elements).

"Most people never address this issue," he said.

"They tell you about the concentrates they can make, but they don't tell you how much money it took them to make the concentrates."

Another aspect of rare earths is supergene rare earth elements (REE) mineralisation, as found in the Mt Weld deposit in Western Australia.

"These deposits came from the mantle and are igneous, composed mostly of major minerals calcite, dolomite and apatite, which have substituted in the structure very small amounts of REE," Dr Mariano said.

"In some areas, under the right conditions, these deposits are exposed to lateritic weathering where the rare earths are released and put into solution and recrystallised to form primary rare earth minerals.

"This is what happened at Mt Weld, but the problem is it is extremely fine grained and hard to treat."