Emerging Trends Report
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2010-11 Australian Precious & Specialty Metal Project Survey

Investment Report #1/April 1, 2010: *Alkane Resources Ltd.* (ASX: ALK)

Mineral Focus: gold (Au), zirconium (Zr), hafnium (Hf), niobium (Nb), tantalum (Ta), light rare earth elements (LREE), yttrium and heavy rare earth elements (Y + HREE)

Why We Are Buying Alkane Resources Ltd:

1. China controls more than 90% of the global market for the critical intermediate zircon compound, zirconium oxychloride.

2. One company in Brazil controls 90% of the global niobium (and niobium products) market.

3. China also controls more than 90% of the global rare earth element and yttrium market and is actively taking steps to assume control of the manufacturing of value-added products containing these elements.

4. All three minerals are generally without substitute and are price inelastic; that is, all three are used in such miniscule amounts in primary applications but are so critical to material performance that price is not a consideration in manufacturing decisions—***availability is.***

5. None experience anything approaching efficient, ie. closed loop, recycling.

6. Alkane Resource's unique ***Dubbo Zirconia Project*** (DZP) will produce significant amounts of zirconium compounds, niobium-tantalum concentrates, light rare earth element concentrates, and yttrium and heavy rare earth element concentrates from a single deposit in New South Wales ***with a 150-year mine life***; we believe this project is a 'company-maker' in that it is likely to fund both the company's organic growth and a long-lived stream of dividends.

7. Within the same geographical region, Alkane Resources is simultaneously advancing a gold project as well as participating as the junior partner (25%) in another sizeable gold and copper resource currently being delineated by Newmont Australia.

Editor's Note: *Other than a hamburger lunch in the field while on the Dubbo site visit, the Emerging Trends Report has received no compensation whatsoever for writing this report. Due to the technical nature of the Dubbo Zirconia Project, however, Alkane's management was invited to review this report to confirm both its technical accuracy and the veracity of our claims regarding their projects; otherwise, the opinions expressed are our own.*

Mineral Market Drivers and Thumbnail Sketches:

To be clear, all of the minerals under discussion here are processed initially into chemical compounds that are likely to in turn be further processed into metals or other end-use products which use their unique properties to advantage. For example, the naturally occurring mineral zircon is processed into a wide range of compounds such as the intermediate product zirconium oxychloride, which is the primary salt from which the majority of zirconium products stem, but it too may be further refined into a high purity metal, such as that needed to meet the exacting metallurgical specifications for use in nuclear fuel rods.

- **Zirconium (Zr)** is noted for its corrosion resistance as well as its ability to maintain its structural integrity at very high temperatures.
    - more than 80% of zirconium use stems from three categories of use:
        - **refractories**: furnace, incinerator and reactor linings; crucible molds;
        - **advanced ceramics and catalysts**: engineering ceramics, electronics, ceramic lattices for suspending platinum catalysts in autocats; estimated demand growth of 13% pa through 2015;
        - **ceramic pigments:** glazes on kitchen and bathroom tiles and fixtures, dinnerware, paint drying agents, automobile primer and undercoating; 8% pa demand growth through 2015;
    - the primary uses of metallic zirconium and hafnium are in nuclear fuel and control rods respectively, with secondary applications in chemical processing and desalination;
    - Australia is the world's largest producer of zircon (zirconium silicate—$ZrSiO_4$), chiefly in the form of heavy mineral sands;
    - usually attended by low concentrations of hafnium (Hf), but expensive to refine;
    - China dominates the basic processing of zircon, ***which they import***, and accounts for more than 90% of the world's supply of zirconium oxycloride ($ZrOCl_2$), otherwise known as ZOC—the basic precursor for the manufacture of zirconium metals and other high value products;
    - the pure element, zirconia (ZrO_2), is the high-value product resulting from further, more sophisticated chemical processing of ZOC;
    - commercial resources, such as Iluka's Perth, Australia operation or Rio Tinto's Richards Bay, South Africa operation are nearing the end of their productive life, and industry specialists ***TZMI expect shortages of Zr by 2012 driven largely by Chinese and emerging market demand***;
    - the US government has no stockpile of zirconium.

- **Niobium (Nb) and Tantalum (Ta):** niobium is the lightest of the refractory metals (tungsten, molybdenum, tantalum and rhenium being the others) with unique metallurgical characteristics including extraordinary resistance to extremes in temperature, corrosion and wear.
    - until the discovery of pyrochlore deposits in Canada and Brazil in the 1950s, Nb was a byproduct of Ta production, its use dictated by its scarcity-driven price;
    - today microalloy and superalloy applications account for more than 95% of Nb use:
        - **microalloy**s: when Nb is added in minuscule amounts to plain carbon steel, it vastly improves the steel's strength and toughness in structural

engineering, transportation, automotive, and oil and gas exploration applications;
        - **superalloys**: used throughout the aeronautical and nuclear industries;
        - also used in **superconducting magnets**, mainly in magnetic resonance imaging (MRI), with increased demand seen in **electronics components**;
    - TZMI: 2007 demand of 63,000 mt to approach 100,000 mt in 2012;
    - one Brazilian deposit contains roughly 90% of the world's known Nb, and Companhia Brasileira de Metalurgica e Mineracao (CBMM) essentially controls the market for Nb products;
    - the US government sold the Nb in the Defense National Stockpile Center in 2006.

- **Light Rare Earth Elements (LREE), Yttrium and Heavy Rare Earth Elements (Y + HREE)** have unique chemical, magnetic and luminescent properties.
    - 60% of REE demand is found in three categories of use:
        - **permanent magnets** in computer hard drives, mobile phones, mp3 players, electric motors etc; demand is expected to increase 22% by 2014;
        - **catalysts**, including petroleum cracking, especially in heavy oil and oilsands, and autocats; demand is expected to increase 17% by 2014;
        - **metal alloys**, notably in hybrid electric and rechargeable batteries; demand is expected to increase 25% by 2014;
        - other significant uses include **phosphors** (LCD, PDP displays and TV screens), **polishing powders**, **glass**, **fiber optics** and **ceramics;**
    - REE are not rare, in fact occur more commonly than zircon, but because they are so chemically similar, *REE are a nightmare to separate economically*;
    - China recognized the opportunity in REE and (unencumbered by profit motive or environmental concerns and able to direct large amounts of both subsidized energy and inexpensive labor at the undertaking) developed the process engineering necessary to dominate the REE and Y market—today there is no competing with the Chinese on REE and Y price;
    - over the last few years China has reduced export quotas, increased export taxes, stopped issuing new REE mining licenses, and taken other steps designed to keep REEs and Y in-country in effect to force manufactures of downstream, value-added products to relocate to China, raising intellectual property rights concerns;
    - China has also begun to stockpile REE and recently announced there may only be a 15-year supply of HREE;
    - IMCOA and Roskill see overall REE demand growing 37-53% from 2008 levels by 2014 and potential shortages of terbium (Tb), dysprosium (Dy) and yttrium (Y);
    - this provides the market with an opportunity, but developing a REE project is a long and capital intensive effort because ***each deposit is unique and requires a tailored processing operation*:** REE and Y recovery in fact should be thought of as sophisticated chemistry rather than typical mineral extraction;
    - ***despite there being more than 70 listed companies claiming to have REE resources, there are currently 8 identified resources of REE outside of China we consider to be potentially economic, of which only 4 are likely to be in production by 2013-14;***
    - the US government has no stockpiles of REE or Y.

Company Overview: Alkane Resources Ltd. listed in 1969 and operated primarily as an exploration company until early '90s, when it successfully transitioned to a gold miner with the Peak Hill project. It is now focused on developing its mineral assets in the region surrounding Dubbo, New South Wales (NSW), which boasts both the requisite infrastructure and a mining-friendly environment. Strong local involvement and more than 15 years of successful operation in the area have translated into the company being a known and respected entity in the area.

- ***Quick financial overview:***
  - management team has been together for more than 20 years
  - with Peak Hill Au project nearing completion (only reclamation and core sampling from Tomingley operating from site), company consists of 5 directors and 8 employees, which will be scaled up as development projects near production;
  - Cash and liquid assets (21.12.2009): A$4.5 mil cash, and A$6.5 mil in BCI stock;
  - Debt: NIL
  - Market capitalization: A$73,500,000
  - Number of shares outstanding: 249,000,000
  - Share price (as of 01.04.2010): A$ 0.295
  - most recent quarterly report: http://www.alkane.com.au/reports/quarterly/pdf/Alkane_Dec_09.pdf
  - most recent annual report: http://www.alkane.com.au/reports/annual/pdf/2008_Alkane_AR.pdf
  - 2009 annual report scheduled for release in mid-April, 2010;

- ***Peak Hill Au project****:*
  - Dubbo region open pit heap & dump leach operation that produced 153,000 oz at production cost of A$350/oz over roughly 9-year period ending 2006;
  - A$5 million in start-up costs coupled with A$60 million in production costs yielded A$85 million in gold sales;
  - a sulfide zone may be exploited to make sulfuric acid for the DZP, with a gold offset;
  - award-winning reclamation project that has *increased the biodiversity of the area*;
  - site now a self-guided historical walking tour of more than a century of operations on the gold resource, and was a 2003 Finalist in the NSW Tourism Awards for Business Excellence.

- ***Nullagine Iron project:***
  - parlayed interest in Pilbara (Western Australian) iron deposit into roughly 15% of BCI Iron Ltd. (ASX: BCI) in order to focus on the Dubbo surrounds;
  - retained 60% of diamond rights.

Current Status: two projects under development (see below) with a third farther down the track:

- ***McPhillamys Au-Cu project****:*
  - not enough lead time to arrange a site visit with Newmont, Australia;
  - preliminary modeling suggests a 2-4 moz. of Au and 50-100,000 metric tons of Cu;
  - potential block caving operation in 75-25% JV w/Newmont Australia;
  - Bankable Feasibility Study due from Newmont Australia within 3 years;
  - no financial contribution required from Alkane during that time;

- Newmont Australia to extend project financing for an additional 5% of project.

Managing Director, Ian Chalmers, regarding the Dubbo Zirconia Project (DZP):

- the DZP is 1 of only 4 projects outside of China containing significant amounts of rare earth elements that are slated to be in production by 2014;
- **the DZP is scheduled to start-up in Q2 2012 and ramp up to full production by 2013-4**;
- the Dubbo ore body, which is a trachyte volcanic intrusive (more below), has a measured resource (JORC compliant) of 35.7 million metric tons with an inferred resource of 37.5 million metric tons that will produce significant tonnages of Zr products (40% by value at current prices), Nb-Ta concentrates (35-40% by value at current prices), and both LREE and Y + HREE concentrates (20-25% by value at current prices) ;
- the mineralization has an elevated high-value Y + HREE content (as much as 25% of total rare earth elements versus typical distribution of roughly 10%);
- DZP assets have been rolled into a wholly-owned subsidiary, *Australia Zirconia Ltd.:*
  - ***the preferred method of financing the A$150 million development cost is via non-dilutive off-take agreements with commercial refiners on a 5-year repayment schedule;***
  - the wholly-owned subsidiary approach expedites cash flow and allows interested parties to participate in the DZP without being exposed to Alkane's gold projects;
  - if needs be, Australia Zirconia Ltd could be spun-off and listed separately;
  - processing the planned 400,000 metric tons of ore per year will generate A$92-112 million per year ***at current mineral prices*** employing a ***high-end*** operational cost estimate of A$65 million per year;
  - Alkane has a history of improving process efficiencies and extending resource life.
- sample compounds and concentrates began being distributed to commercial refiners in the second half of 2009, and negotiations are underway to secure off-take agreements with a number of interested parties;
- ***this combination of short repayment schedule with long mine life (> 150 years) for high-value specialty metals promises to both help finance the company's organic growth as well as to throw off significant dividends in the years ahead;***
- other details from our conversations have been assigned to the pertinent section of this report, but other miscellanea include:
  a. the largest operational expense of the DZP is sulfuric acid, and with both the Newcastle and Wollongong chemical plants closed, being forced to import sulfuric acid is a distinct possibility; Alkane is exploring the feasibility of exploiting a significant sulfide zone at their Peak Hill gold property to produce what they need, perhaps recognizing a gold byproduct offset in the process;
  b. mining uranium is not legal in NSW, but the DZP will also contain an uranium byproduct (0.014% U_3O_8), which will exist in tailings at a lower concentration than extant in the ore body; should the laws change, the uranium could be recovered and shipped to South Australia and processed profitably.

Demonstration Pilot Plant (DPP) Visit:

- over the course of 13 years, the last 4 years in conjunction with scientists at the Australian Nuclear Science and Technology Organization (ANSTO), ***Alkane has developed the world's first flow sheet and working Demonstration Pilot Plant producing highly specialized compounds and concentrates from a multi-metal resource****;*
- there is a lot of speculation about recovering the rare earth elements in tailings, especially those attendant to uranium and thorium mining, such as those at Mt. Elizabeth in Australia, but it is critical to bear in mind that it is not the availability of rare earth elements that is in question but the economics of doing so: each occurrence is unique, location-specific and can only be addressed by a customized process, rendering development slow, painstaking and expensive because ***there is no single cross-resource process approach***;
- ***this constitutes a significant barrier to entry***: the DPP was 10 years in the making and Alkane experimented with 4 different process approaches before having their *Eureka!* moment;
- unlike a typical heavy mineral sands operation, for example, which employs a somewhat generic physical separation process to produce the raw mineral zircon, the DZP deposit is a homogonous volcanic trachyte intrusive that required a customized recovery process; however, as a consequence of the custom process, which is akin to basic refining, ***the DZP will not produce the mineral zircon but higher value zirconium products***;
- an overview of the DZP and **processing flow sheet** are available on page 8 of this presentation: http://www.alkane.com.au/presentations/pdf/20100201.pdf
- because the process of recovering zirconium compounds from the predominantly iron and aluminum mineral host has produced a leach solution pregnant with metals, it facilitates the recovery of Nb-Ta concentrates, LREE concentrates, and Y+HREE concentrates through separate, subsequent solvent extraction streams; ***this is what makes the DPP a world first;***
- apparently more by accident than design, ***the process naturally separates the LREE constituents from the higher value Y+HREE constituents;***
- photography is not allowed at ANSTO, but the Demonstration Pilot Plant struck me as much as a big kid's chemistry lab run amok as a functioning mineral processing plant: a multi-level series of dusty vats of varying sizes were inter-connected by a spaghetti confusion of plastic piping, with most vats being endlessly stirred by quietly humming electric motors to keep the minerals in solution or to encourage them to come out, and fluids were ceaselessly being pumped from one vat to another while this, that or the other chemical was added or leached out—you may have gathered that as a retired English professor, chemistry was not my strong suit, but as you walk through it with a process engineer patiently explaining it to you, the A to Z progression all makes sense…at the time;
- the four goals of the Demonstration Pilot Plant (DPP) were:
    1. to confirm the viability of the processes;
    2. to run the DPP at the designed operating rate of 1.4 metric tons/day (t/d) to produce roughly 6.3 kilograms per day (kg/d) of zirconium products, 7

kg/d of Nb-Ta concentrates, 7 kg/d of LREE, and 2 kg/d of Y+HREE, samples of which were to be distributed to commercial refiners for evaluation;

3. to generate the engineering data required to translate the DPP into a full-scale plant capable of processing 400,000 metric tons per year;
4. and, ***once the Zr and Nb-Ta recovery module was set***, to fine-tune the process efficiencies and to establish the marginal costs of Y+HREE recovery through the final refining circuit module (see flow sheet), and to ship the concentrate to commercial refiners for evaluation.

- the DPP ran continuously (24/7) for two one-month intervals, interruptions utilized to fine-tune processes, and then continuously for roughly 3 months;
- currently, the DPP is being run to maximize the process efficiencies attendant to the recovery of the last module—that of the recovery of Y+HREE—and samples are slated to be sent to commercial refiners by May, 2010;
- samples of DPP compounds and concentrates (which look surprisingly like vacuum-packed crumbled goat cheese) are currently being further refined via fine chemistry into individual elements or to meet specific customer specifications by a variety commercial refiners worldwide;
- although the names of these commercial refiners, who will be the ultimate buyers of DZP products as well as likely being involved in off-take agreements to fund the project, could not be disclosed for confidentiality reasons, the list of candidates is not long: Baotao, Rhoda, Neo Materials, Shinetsu, Silmet, Lynas and Molycorp;
- as soon as the DPP flow sheet is finalized, the momentum of the decade-old project will noticeably accelerate as environmental permitting, the bankable feasibility study, project finance and detailed design work will all advance rapidly toward construction;
- ***the DZP plant is slated to start-up in Q2 2012 and will scale up to process 400,000 metric tons of ore per annum (tpa),*** or roughly 1100 metric tons per day***, yielding 6,000 tpa of high-value Zr products, 2,000 tpa of Nb-Ta concentrates, or 1,400 tpa of Niobium Pentoxide, 1980 tpa of LREE concentrates, and 602 tpa of Y + HREE concentrates***—for 150 years.

Dubbo Region Site Visits:

- all three of Alkane's primary projects are located within 90-minutes of Dubbo, NSW; unfortunately, we did not have sufficient lead time to arrange with Newmont, Australia to see the MacPhillamys project;

- ***Tomingley gold project***:
  - 800,000 oz. open pit carbon in leach operation with an estimated cash cost of A$750/oz (US$675), which is certainly competitive;
  - three distinct ore bodies, Wyoming 1, Wyoming 3, and Caloma, the latter of which has recently produced high grade intercepts with potential for underground extension (please refer to the company website for details);

- the project will require A$85 million in capital expenditures to put into production, which includes 45 kilometers of water line, 20 kilometers of 66 kVa electrical line, crusher, mill, processing plant and the requisite site work;
- excavation and haulage may be farmed out as it was with the Peak Hill project;
- ***the preferred method of financing the project would be through the combination of bank loans and convertible notes which would not be immediately dilutive;***
- the final investment decision is slated for late 2010, and production for 2012;
- Alkane anticipates A$20-25 million free cash flow per year;
- with the ore body largely defined, only one diamond drill rig was operational on the day of our visit conducting a step-out delineation;
- at the Peak Hill site office, where continuing reclamation efforts as well as new core samples are warehoused, I was shown both visible gold in core samples as well as a simple example of what ore from the sulfide zone manages when left to its own devices (see photograph on page 10);
- roughly 85 people attended a community consultative meeting in Tomingley in April 2009, and there were no objections to the Tomingley gold project;
- there is local and indigenous support for project.

- ***Dubbo Zirconia Project:***
  - The ore body is a relatively rare alkaline volcanic outcrop known as the Toongi trachyte that is rich in the target minerals and is interrupted by only a few narrow basalt dykes;
  - the site is roughly 30 kilometers (18 miles) from downtown Dubbo,
  - the deposit has literally no overburden and stretches along a ridge over an area measuring roughly 900m x 500m and has been drilled extensively to a depth of 50m and sporadically to a depth of 110m;
  - the ore body extends across three properties: Alkane has secured an option to buy one property and is in negotiation to purchase the other two; similarly, negotiations are ongoing for the land on which the plant will sit as well as for an easement to facilitate most-direct-route haulage;
  - tramping over the deposit, which is essentially a series of exposed rock shelves with sporadic patches of shallow vegetation and trees struggling for purchase (see photograph on page 12), GM NSW Mike Sutherland handed me a lump of unremarkable reddish tan rock of a vaguely sandstone texture with the comment, *"doesn't look like much, but that contains half the periodic table"*;
  - there is little or no overburden, just ore, which means little waste;
  - will probably only need to campaign mine a few months a year: 400,000 tons of ore only amounts to about 160,000 cubic meters;
  - because it would be idle much of the year, Alkane is as yet undecided whether to purchase the mining equipment or to contract mining services as they did for their Peak Hill gold project;
  - there is an existing but decrepit railroad spur line that conveniently terminates only a few hundred meters from the proposed plant site, but it will require renovation and the re-installation of three railroad crossings in Dubbo and two across Obley Road at an estimated cost of A$6-7 million;

- Alkane anticipates one or two trains a week delivering sulfuric acid, organics and quantities of limestone to neutralize the waste;
- electricity, water and natural gas are no farther than Dubbo;
- incorporating the results of detailed surveying into their project designs has enabled Alkane to large avoid heritage and indigenous issues.

Conclusion:

Alkane Resources Ltd. is precisely the kind of listed company we came to Australia to investigate, evaluate and to recommend to our clients. Largely unknown to North American investors, the Dubbo Zirconium Project will produce significant quantities of three increasingly important, price inelastic specialty metals literally for decades to come.

Demand for these metals continues to increase at the same time supply is being constrained by a range of factors not easily overcome, not least being the difficulty of developing a flow sheet to bring these types specialty metals to market economically; ***this constitutes a significant barrier to entry that is not widely appreciated by equity markets.*** Unlike the vast majority of companies today that claim to have this, that or the other specialty metal, Alkane Resources Ltd. is the real deal. The Dubbo Zirconia Project provides investors with long term exposure to a polymetallic ore body balanced between three specialty metals with very attractive growth and demand profiles; we believe this will absorb a degree of volatility because it is unlikely demand for all three will decline simultaneously.

That being said, we also established a broad set of guidelines we were looking for in a company in order to add a margin of safety for our clients. Although Alkane Resources Ltd. possesses a stunning resource and a seasoned management team, it does not meet two criteria—namely, they are not fully funded and permitted, and are roughly two years away from production. ***Considering the way Alkane's share price has been steadily drifting lower over the last few months despite the good news emanating from the company, our guess is the market is focusing on the challenges attendant to funding the development of two projects simultaneously.***

This is a legitimate concern. Further, twin underlying threats to resource project development today are the possibility of the global financial crisis rearing its ugly head again and the chance of sovereign debt issuance throttling private sector credit availability. However, we are convinced the market will not let an opportunity like the Dubbo Zirconia Project go wanting: ***the world is too desperate for all three categories of specialty metals.*** In our opinion, Alkane will be able to put the Dubbo Zirconia Project into production based primarily, if not entirely, on off-take agreements. Samples of the Zr compounds and Nb-Ta concentrates have been in commercial refiners' hands for roughly six months, and the latest LREE and Y+HREE concentrate samples soon will be; meanwhile, off-take agreement negotiations have been ongoing.

When Alkane announces it has secured off-take agreements to fund the DZP, and we believe this is clearly on the horizon, it will nearly triple its market capitalization and have a similar effect on its share price—literally over-night. We are coming in toward the later, clearly most critical, stages of this lengthy process, and we like what we see—and we believe the market will soon too. Consequently, we would prefer to buy shares now while they are languishing, even if it means more downside until these questions are answered, than to risk missing the move when the off-take agreement is announced.

Readers are familiar with our position regarding gold, so we will not belabor it here. Judging from their success at Peak Hill, which was largely predicated on improved process efficiencies and management ingenuity, we are optimistic Alkane will again under-promise and over-deliver with their Tomingley gold project, mostly likely coaxing more gold and a longer mine life from the project than is currently expected.

Once the Dubbo Zirconia Project is scaled up and starts meeting its production targets, we believe the market will come to share our view that this long-lived asset is a veritable cash cow that Alkane Resources Ltd. will use not only to fund other projects in the Dubbo region but also to throw off a sustained dividend stream for shareholders.

In short, we view the Dubbo Zirconia Project as the Alkane Resources Ltd. 'cake' and the Tomingley and McPhillamys gold projects as a very rich (> million oz) 'icing.'

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Core samples from the Peak Hill gold mine's sulfide zone left to their own devices (water and air). The DZP's most expensive input will be sulfuric acid, which this deposit may provide, complete with a gold byproduct offset.

ETR's Richard Karn atop the alkaline volcanic intrusion known as the Toongi trachyte that constitutes the Dubbo Zirconia Project's ore body. Note the lack of overburden. In the background is some crushed ore awaiting transport to the Demonstration Pilot Plant at the ANSTO facility in Lucas Heights.

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