EXPLORATION AND DEVELOPMENT OF INDUSTRIAL MINERALS DURING 1994

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MINING LAWS AND RELATED DEVELOPMENTS

The Clinton Administration projected that an 8% royalty will be imposed on hard rock mining on public lands. The fiscal 95 budget projects $16 million will be collected in 1996 from the royalties and will gradually increase to $100 million.

In 1993, the House passed a bill calling for 8% royalty on smelters net returns plus more restrictions on land use, a royalty figure that met with opposition from mining organizations and most senators from western states. By contrast, the Senate passed a bill that called for a much lower royalty of 2% and this bill was endorsed by the mining industry. In what is seen as a compromise, another bill was proposed for a sliding scale gross royalty, but this has also met much opposition. Still another proposal includes a 5% net royalty. Regardless of the final agreement, it appears that the patent system of the 1872 law will be eliminated. This feature allows mining companies to acquire title to federal land for $5.00 an acre.

Another point of contention has risen in the debate over revising the United States Mining Law of 1872, namely involving water quality. Some of the western states have said existing state laws protecting surface and ground water quality are adequate and should not be changed as a result of mining law reform. By contrast, some environmentalists contend that states do not have adequate staff to inspect the mines properly and are influenced by local politics.

The squabbling over mining law reform finally threw the topic into the next session when Congress could not agree. The latest Senate proposal included a 3% royalty for gold and 2% for other metals. Even some mining company executives expressed disappointment because they felt the industry had made large concessions.

Poland has adopted a new mining law to replace the law in force for the past 40 years. The new law attempts to provide a balance between the need to mine resources and environmental protection and includes licensing, work safety underground, responsibility for damage from subsidence, and environmental protection. The old law strongly favored mining companies, because no matter how much

damage was done, the company was only required to meet the cost up to that for building a single family house.

On March 29, Australian mining and Aboriginal leaders met together for the first time in what is hoped will be the beginning of a series of meetings eventually leading to settlements of disputes over land rights, land access, and related problems.

China has imposed a 1.2% tax on mining companies. The levy is calculated on the basis of the value of mineral ores mined, including gold, manganese, and phosphorus and will be fixed for two years. Afterwards, the rate will increase between 5-7% between 1996 and 2000 and then further increase to 10%. Proceeds will be used for geological prospecting. The tax applies to both domestic and foreign ventures. Considering the antiquated conditions of many mines and the need for foreign investment, it will be interesting to observe the effects of such a tax.

The linking of asbestos to cancer incidence has led to an abrupt fall in demand and the closure of many mines and processing/product facilities. Those companies that still exist face a prolonged period of claims and expenses. In an effort to speed the process, the agreement has been reached between some claimants lawyers and industry representatives (Center for Claims Resolution) to provide compensation of $1 billion over the next 10 yrs. for an est. 100,000 victims of mesothelioma plus varying amounts for victims of other cancers and non-malignant diseases. It is hoped that other companies will become involved in a second similar plan and remove some of the uncertainty hanging over the industry.

PROBLEMS IN THE RUSSIAN MINING INDUSTRY

A brief summary of a paper presented to Royal Institute of International affairs in London by David Humphreys "Mining and Metals in the Commonwealth of Independent States - Between Autarky and Integration." shows the present state of the mining industry in Russia (Mining Journal London 322 (8264) p 142-143) It is available through the Publications Department, Royal Institute of International Affairs, Chatham House, 10, St. James Square, London,

SW1Y4LE, United Kingdom. The price (in pounds) is 9.50 plus 1 postage in Europe and 2 outside Europe.

In general there is an overall lack of planning and marketing problems including:

(1) deposits reported in past may or may not be of value. The economically viable nature of a deposit is often not considered. Often the cut off grades and cost of production was not considered as much as the technical possibility.
(2) Estimates, more like guestimates, of deposits have been made by outside observers and, because details were never or seldom available to outsiders, both under and over estimates have been made with regard to production as well as reserves.
(3) Large distances may exist between a deposit and the processing facilities, thus leading to horrendous transportation charges.
(4) Most of the mining industry is suffering from under investment.
(5) Many deposits are being mined with poor grades of ore (by western standards).

An example was given of a kaolin mine in the Ural Mountains that was operating at a depth of over 3000 ft.

ATLAS

Saudi Arabia has published an atlas of the country's industrial minerals based on 25 years of research and published reports on known occurrences. For each industrial mineral, the book provides a description of the mineral, its geological environment and a description of the major occurrences in the country. Copies may be obtained from the Directorate General of Mineral Resources, P.O. Box 345, Jeddah 21191, Saudi Arabia. No mention is made of price.

NOSTALGIA

The last ponies to work in Britain's underground coal mines retired.

At one time, British Coal's Ellington Colliery in Northumberland used 80 ponies. The ponies worked identical shifts as threir handlers with the same rest and meal breaks. They were well treated, were washed and cleaned at end of each shift, and were checked daily by a ferrier.

MISCELLANEOUS AND SEMI-PRECIOUS GEMSTONES

Natural sapphires command very high prices (up to $1,400/ct) relative to synthetic stones (approximately $10/ct). Almost all of Montana's sapphires, as recovered, are not gem quality but by proper heat treatment, can be upgraded to gem quality. About 90% or more of sapphire gems supplied to the market are heat treated to improve the quality, color, and clarity and since no additions are made during the treatment, they are considered natural gems.

The recent acquisitions of sapphire properties in southwestern Montana and recent technology encompassing the heat treatment to upgrade rough sapphires to gem quality may allow American Gem Corporation to become a major sapphire producer and control 10% of the world market, currently around 75 Mct/yr. The properties involve alluvial gravels along Dry Cottonwood Creek as well as the El Dorado Bar on the Missouri River and on Gem Mountain. Some of the Dry Cottonwood gravels have yielded as 1,000 carats per cubic meter.

Several other noteworthy discoveries were reported. Benride Pty has discovered both sapphires and diamonds in New South Wales, Australia and is currently searching for a joint partner to help evaluate and possibly develop their leases. Although details are not available, the gemstones tanzanite and tsavorite have been been reported in association with graphite in the Merelani deposits in Tanzania. A large deposit of semi-precious stones, notably opals, has been found in the Sagua-Baracoa Mts. near the town of Moa in eastern Cuba. Blue Emerald Resources has leased more land near the Vernon area of British Columbia, Canada, where several opal discoveries have been made. Blue Emerald feels the multiple finds suggest a large opal field. Finally, a large (no data given) amethyst deposit has been found near Kurdzhali, Bulgaria and a commercial

company has been organized to mine and process the amethyst-bearing deposits for jewelry.

GRAPHITE

Roselis Mining Co. is seeking partners to develop two possible open pit graphite deposits located near coastal town of Swakopmund. One deposit has estimated reserves of 12 Mt with 6% large-flake graphite and recoverable rutile and pyrite by-products. The other site is believed to be around 20 Mt but grade and flake size are unknown.

After completing a similar plant in Tauzaure, Metatturgical Design and Management and Unique Engineering are planning to construct a graphite recovery plant in Malawi.

The first phase for recovery of graphite from the Merelani deposits in Tanzania have been completed by an engineering joint venture and have now moved into the second phase which involves the design and construction of a crushing, mulling and flotation plant. This development is the first major ore body to be exploited through private funding since Tauz gained its independence. The project is managed by Graphtan. The Merelani deposits are unusual. They consist of a kyanite gneiss that contains coarse flake, graphite and an altered ore which not only contains a coarse flake graphite but also contains tanzanite and tsavorite, precious gemstones.

HARDROCK TITANIA

Teck Resources Inc., a division of Teck Corp., has acquired 100% interest in the Powderhorn titanium deposits near Gunnison, Colorado, USA. The deposit is believed to be the largest titanium source in the United States with reserves of 450 Mt averaging 11.5% titania. The deposit is unusual in that the source of titania is not the typical rutile (titania) or ilmenite (iron titanate) beach sand minerals but rather calcium titanate, known as the mineral perovskite. The deposit is also significant because the United States currently produces a third of the worlds titanium dioxide pigment but must rely heavily on imports (40%) for its feedstock requirements.

MINERAL SANDS

The newly formed board of Sierra Rutile Holdings Ltd. (recent merger of Consolidated Rutile Ltd. and Sierra Rutile Ltd.) has approved continuation of a five-year expansion program that will increase rutile production about 40,000 t/yr to a total of190,00 t/yr. Located in Sierra Leone, West Africa, the mine is the largest rutile producer in the world and also produces a lesser amount of ilmenite (60,000 t in 1993).

Deposits of what appear to be valuable heavy mineral sands have been discovered by India's Minerals Division of the Ministry of Mines at the east Godavari region of Andhra Pradesh, north of the port of Kakinda. A 6 mile (10 km) stretch of sands is reported to average 55% heavy minerals with a high zircon content. Farther north are an estimated 10 mt of sands with 50% ilmenite.

A joint venture is being formed between India's National Mineral Development Corp., Indian Rare Earths Ltd., and Andhra Pradesh Mineral Development Corp. to mine ilmenite-rich beach sands at Bhimunipatnam.

According to the Dept. of Metallurgy at the Univ. of Bangladesh, there are sufficient beach sand deposits along 17 selected coastline areas to supply domestic needs for 25 years. The areas contain ilmenite, zircon, rutile, and magnetite. Interest in exploring and permitting has been expressed by Specified Minerals Pty Ltd. of Queensland, Australia.

Tiomin Resources (Toronto) continues to be encouraged by results obtained from their Natashquan mineral sands property located on the north shore of the Gulf of St. Lawrence in Quebec. As mentioned in last year's review (Open File #94-61) the deposit is estimated to contain 1.18 billion tons of sands with an average heavy mineral content of 6%. Assuming that figure and the proposed 26 Mt/yr mining rate, the deposit would last 45 years. The company anticipates annual recovery rates of 426,000 t of magnetite, 284,000 t of titaniferous hematite, 190,000 t of ilmenite, 33,000 t of garnet and 8,000 t of zircon. Tiomin has not yet decided on a plant location

but may elect to convert the magnetite and ilmenite to iron and titania respectively.

Renison Goldfields Consolidated has become a joint venture partner with a local company for further exploration and evaluation of the titanium mineral deposits in the Ukraine. Preliminary work by Renison suggests the potential for several large scale commercial operations including some tailings from existing operations that apparently still contain appreciable ilmenite.

While it is too early to tell if and when the project will begin, the groundwork is being laid to develop a rutile project in Cameroon. Work in the 1970's indicated reserves of 300,000 t and a projected mine lifetime of 10 years. If sufficiently more reserves can be found to support a 50,000 t/yr operation, the project may well succeed. It would be Cameroon's first large-scale mining operation.

The first heavy mineral exports derived from the Namakwa sands along South Africa's west coast are expected to hit the market by year-end. Included are annual production of 120,000 t of zircon for the ceramics industry as well as 135,000 t of rutile. In addition, the ilmenite fraction will be processed to yield 195,000 t/yr of titanium slag and a corresponding 120,000 t/yr pig iron. Apparently, sales contracts have been agreed upon that cover the bulk of the annual production for the 30-year life expectancy of the operation.

Scientists from the University of Groningen have found heavy mineral sands containing zirconium and titanium in the Wadden Sea sediments off the northwest coast of the Netherlands. The area is characterized by sand banks deposited where European rivers enter the North Sea. Because of the environmental importance of the area, the question remains as to if and when the deposit might be developed.

Australian Fused Materials plans to construct a fused zirconia plant alongside its fused alumina operation located at Rockingham, Western Australia. The plant will convert 5,000 t/yr of zircon into 3,000 t/yr of fused zirconia and 1,600 t/yr of high grade silica fume.

POTASH

The short term outlook for the potash market appears lackluster. The bulk of this commodity is consumed in developed countries that are relatively saturated markets and overall consumption continues to slowly decline. However, a slow recovery in selecteed areas has a stabilizing effect, based mainly on markets in Asia and C.I.S. where many areas are under-fertilized. New operations possible in these countries will impact exports from major producers.

Sociedad Quimica y Minera de Chile (Soquimich) plans to develop its Minsal potassium-lithium-borax deposit in northern Chile. Plans include an 80,000 t/yr potassium chloride output, eventually increasing to 300,000 t/yr. The plant will eliminate purchases by the company for its potassium nitrate business and savings estimates range around $10 million/yr. The company is also studying the potential construction of a lithium recovery plant that could produce 20 M lb/yr, about one-third of current global output.

Asia Pacific Resources (Vancouver) core analyses from the Udon Thani potash concession reveals sylvinite layers at relatively shallow depths of 1.9 to 5.9 m thick with grades of 26-31% K2O. These results are encouraging and their strategic location suggests mine development. The deposit in northeastern Thailand close to the Laotian border coupled with a direct road between Laos and China and projected demand increases for potash in southeastern Asia indicates these deposits would have less transportation costs relative to imports.

As the company neared completion of its drilling program later in the year, further encouraging results were obtained that indicated a total of 500 Mt reserves with 50 Mt as sylvanite ore with an average grade of at least 27%. Total potash thickness in the 10 km^2 area is about 30 m (~100 ft) with an average sylvinite layer of 3 m (~10 ft). The company intersected a high grade (grade not given) 11 m (35 feet) thick zone of sylvanite at a depth of 263 m (850 feet).

SULFUR

Freeport-McMoRan Resource Partners announced its Main Pass Frasch sulfur mine off the Louisiana coast is now at full production, 5,588 ft/day or 2 Mt/yr. The company anticipates at least a 30 year lifetime for the operation. The company said it expects minimal impact on the sulfur market which is suffering from oversupply and low prices, in part because of the planned closure of Caminda, its other Frasch mine in the Gulf of Mexico, very soon.

PHOSPHATE

Phosphate rock production has declined from 153.7 Mt in 1990 to 117.3 Mt in 1993. The United States is the worlds largest producer and production has declined from 46 Mt in 1990 to 35 Mt in 1993. The most dramatic drop in production occurred in Russia and the C.1.S. (more than half with 35 Mt in 1990 declining to 16 Mt in 1993). Most of this situation is a supply-demand situation with oversupply leading to lower prices and subsequently less production.

Morocco hopes to gain from the recently concluded GATT talks that will lower customs duties on phosphate exports by 30-50%. It is felt that phosphate exports will expand as a result of the lower duties.

Viet Nam exported some 40 t of phosphate fertilizer to France and Australia marking the first phosphate exports from Viet Nam.

Last year, Australia agreed to pay Nauru $A107 million over 20 years as an out-of-court settlement for mining phosphate from Nauru for 90 years. New Zealand, as well as Britain, have agreed to pay their share by each paying Nauru $A12 million of the $A107 million total.

BAUXITE/ALUMINA

A chronic oversupply has seen prices drop during the past 5 years. High prices in late 1980's led to a rush of new operations and major capacity expansions. As yet, some countries have shown little to no

cutbacks in production and that puts western producers, who as a whole, seem willing to cut back production if other countries do likewise, in a bind. Early in the year, most cutbacks announced were from the top-producing countries (U.S., Canada, Australia) and Europe. Brazil has not announced any cutbacks and they are the world's fourth largest producer. Initially, Russia agreed to an 0.5 mt/yr cutback (at the Brussels meeting of world aluminum producers in January), but then announced they were suspending cutbacks as they were not satisfied with other countries cutbacks. Most industry analysts believe a period of short term pain for long term gain is necessary. Near term, the outlook is not very encouraging.

Aluminum metal, alumina and bauxite are intertwined with bauxite as the hydrated aluminum oxide mineral used to produce alumina (the oxide) and most oxide reduced to the metal. Considering the current oversupply, it is surprising to see how strongly the price for aluminum has increased. Between November 1993 to November 1994, the price rose from $1,050/t to a little over $2,000/t.

The question arises as to whether a shortage will develop in the western world if production cutbacks continue? Japan feels it could happen but it seems doubtful. There have been too many new and expanded operations. If the market suddenly booms, it remains a possibility.

Probably the biggest merger in the industrial minerals sector in recent years was that of Aluminum Company of America (ALCOA) and Western Mining Corp. Holdings (WMC) of Australia. The merger includes alumina, alumina-based chemicals and bauxite mining businesses. Subject to all approvals, the merger is effective Jan. 1, 1995 and the new company will be the largest in the alumina industry, accounting for 25% of the world alumina market.

The Geological Survey of India has found six areas containing massive pisolitic bauxite in the Pandrpat Plateau. The Survey estimates the total recoverable reserves of bauxite in the country to be over 2.5 billion tons.

Larsen and Toubro, India's largest private engineering company, is

studying the possibility of a joint venture with the Aluminum Company of America to mine Indian bauxite in eastern India (Orissa) and convert it to alumina with the production goal of 1 Mt/yr alumina, exclusively for export. Three other projects, all in Orissa with a goal of 1 Mt/yr, are also being discussed as possible joint ventures between Larsen-Toubro and other world producers.

Also in the state of Orissa, Indian Aluminum Co. has approved the 1 Mt/yr alumina plant. Production costs are calculated to be $80/t relative to the world average of $142/t.

Guyana announced it is planning to both revitalize and privatize its bauxite operations with loan assistance from the World Bank.

Despite the world oversupply, Jamaica increased its bauxite production in the first 6 months of the year to 5.8 Mt, up from the 5.4 Mt in the like period in 1993.

Guinean officials concede that the current oversupply and low prices are having a drastic effect on exports of which bauxite is the main component. The government expects 1994 exports to be only 45% of that for 1992. A similar drop has occurred in Aredor's diamond production over a five year period.

Ghana Bauxite Co. is considering construction of an aluminum sulfate plant for the regions water industries. The projected 1994 sales of approximately 450,000 t is up significantly from the previous 3 year average of 360,000 t/yr.

A new bauxite mine, The Aumina Mine, has begun production in the central province of Manica, Mozambique. The mine is expected to produce 10,000 t/yr for export to neighboring Zimbabwe. The mine is said to be able to double annual production in a short time, thereby giving it the potential to export to other countries.

Citing poor demand, Bakonyi Bauxitbanya temporarily closed its four bauxite mines in Hungary for the last week in January. It is Hungary's only bauxite mining company.

In an attempt to diversify their almost wholly oil and gas based

mineral industry, the government of Saudi Arabia announced new mining projects. Included are the Az Zabirah bauxite deposit (Quassim-Hail region) with a goal of producing 2.5 Mt/yr and the Al Jalamid phosphate deposit (Sirhan-Turayf basin) with a goal of 4.5 Mt/yr of pelleted phosphate. Later in the year, the country announced the planned construction of 2.55 Mt/yr cement plant with construction by German firm, KHD Humboldt Wedag, AG.

A surge in alumina exports to Russia from Australia is expected as a result of an agreement still awaiting final approval to supply six Russian smelters in Siberia. The smelters are in relatively good condition and are located in an area with abundant hydroelectric power. Russia feels the future of the country's aluminum industry is strongly tied to these smelters. Australian alumina exports to Russia, 25,000 t in 1993, could increase dramatically to 600,000 t, a 24-fold increase.

Australian Fused Materials plans to expand its refractory grade fused alumina plant and double its current production to 20,000 t/yr.

China reports its large bauxite area in the southern Guangxi will soon begin production after 3 years of development. The area is expected to produce 1.9 Mt/yr of bauxite.

FELDSPAR PROCESSING EQUIPMENT

Most feldspar production includes a magnetic separation process to upgrade the finished product. In Finland, Partek Industrial Minerals Ltd. has replaced the common electromagnetic induced roll separators with two rare-earth magnetic roll separators. The latter area believed to be the largest of their type with a process width of 1.5 m (~5 ft.). The plant now has two process streams instead of the previous twelve and is said to have improved efficiency and quality of the product line. The rare-earth separators are manufactured by International Process Systems, Inc., 18301 W. Colfax Ave., #T2, Golden, CO 80401.

CLAY

In an effort to expand Kaolin exports, a combination of production expansion, new processing equipment, and a new mine are planned in Brazil. About half of Brazil's kaolin production comes from the Jari mine (Jari River) operated by Caulin da Amazonia and plans are to more than double production from last years 450,000 t to 1 Mt/yr. In addition, a spray dryer was installed at the mine last year that will provide more favorable characteristics for the product (flowability, magnetic separation of iron, lighter color, and slurry characteristics) instead of its previous lumpy nature. The company has also entered into a joint venture with Companhia Vale do Rio Doce to mine the Rio Capim deposits with a production goal of 1 Mt/yr by 1996. The new mine will include a slurry pipeline of 90 miles (150 km) to the port of Belem on the Amazon River where the Kaolin can be blended with the Jari mine to produce a variety of kaolin products.

China is studying the possibility of mining kaolin deposits at Leiyang (southern Hunan Province). Derived from schistose granites, the kaolin is of high quality and suitable for paper coatings. At present, China imports such kaolin (20,000-30,000 t/yr).

WOLLASTONITE

Attempts to develop a wollastonite deposit near Colmenar Viejo, roughly 20 miles north of Madrid, has met with a surprising amount of protests. The area, with an estimated 12 year lifetime (no reserve figures given), would be subject to environmental regulation and is not considered a particularly beautiful area so the protests are somewhat surprising.

Desarrollo de Recursos Geologicos (Salamanca, Spain) has spent the last two years exploring their Illustacion wollastonite deposit, located near the border of Spain and Portugal, and results indicate at least 20 Mt of reserves with an average grade of 35% wollastonite. The company is seeking financing or a joint venture partner for development to the final product. The market for wollastonite is expected to grow substantially during the near term due to its use in

the ceramics industry and as a substitute for asbestos in certain applications.

OTHER INDUSTRIAL MINERAL SALTS

Gwalia Consolidated plans to expand their operations by constructing a 5,000 t/yr lithium carbonate plant at its Greenbushes mine south of Perth in Western Australia. The plant is expected to begin operating mid-year 1995.

Jordan, while producing 1.8 Mt/yr potash, is seeking to further diversity its mineral industry by taking advantage of the mineral-rich, Dead Sea area. Among its plans are a 50,000 t/yr bromine plant, a 50,000 t/yr magnesium oxide plant and a potassium sulfate plant.

Western Ag.-Minerals Co. is seeking additional water at its Langbeinite mine near Carlsbad. The potassium-magnesium sulfate mineral is processed into separate sulfate salts but has asked water management consultants to develop alternative water sources.

A strontium deposit found in northwest China's Qinghai Province, and, according to the Geological and Mining Bureau, contains about 18 Mt of near surface ore. No details were given as to whether the deposit is a sulfate, carbonate, or other salt but the Quaidam basin in this province is rich in sodium,potassium,magnesium, and lithium salts as well as Br.

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The remainder of the information for this review was obtained from the Mining Journal, London, Volumes 322 and 323, 1994, published by The Mining Journal, London, England. Some of the information is also present in other mining related journals such as Mining Magazine and Engineering and Mining Journal.