Club Pro' Mines et Carrières Lasalle Beauvais Alumni

REVUE DE PRESSE SCIENTIFIQUE, TECHNIQUE ET ECONOMIQUE

4ème année Ingénieurs Spécialité Géologie, Promotion 076

Parcours d'Approfondissement en Mines et Carrières

N°3 : Février 2015

Numéro Spécial Métaux Rares

Consultez l'historique sur le site du Club Pro' Mines et Carrières

Contenu

Research on the evolvement of morphology of coking coal during the coking process

ZHONG X., WU S., LIU Y., ZHAO Z., ZHANG Y., BAI J., XU J., XI B., 2013

This work aims to study the morphology and the structure evolution of metamorphic degrees during the coal rank, the petrological composition behavior have an important role infared Image detector the radial direction of the temperature and the cracking formations were studied. In addition an optical microscope has been used to characterize coking coal macerals and microstructure of metallurgical coke (Enkins et al., 2010; Nandita et al., coking coal blending different observations done on gas coal, 1/3 coking coal, fat coal, coking coal and that the cracking amount and the shrinkage level of char decrease to the initial cracking temperature simultaneous increase of the appearing temperature of the cracks with the metamorphic

References: ZHONG X., WU S., LIU Y., ZHAO Z., ZHANG Y., BAI J., XU J., XI B., 2013. The evolvement of morphology of coking coal during Sciences 2013, 25(Suppl.) S186–S189.
http://www.sciencedirect.com/science/article/pii/S1001074214606537
Key words: Coking coal– coal rank - petrological composi9on – temperature cracks appearance - shrinkage behavior– Infared Image detector

Marine DELESALLE

New Tungsten Mine in UK

CLARK R., 2015

The Hemerdon project is on track for production. 80% of the required infrastructures are now already installed and the construction of mine wastes facilities are 60% completed. First production activities are planned to be launch next summer. Hemerdon tungsten mine is located at 10 km Plymouth in Cornwall inUnited Kingdom and will be exploited by the company Wolf Minerals LTD. Hemerdon is expected of releasing an amount 3,450 tonnes of WO3 and 460 tonnes of tin a year during 40 years, according to the latest announcement by Wolf Minerals on the 23 February 2015. It will correspond to 3% of the global tungsten supply. The tonnage has been estimated on a cut-off grade of 0,063% of WO3. Tungsten oreconcentrate will be afterward sent at 80% to *Global Tungsten & Powders* (*Plansee*, United States) and to the Austrian company *Wolfram Bergbau und Hutten* (*Sandvik*) for being processed into tungsten carbide. However, further tungsten mining project are also on study worldwide. These projects are conducted by the following companies: *King Island Scheelite*, *Ormonde Mining*, *Woulfe Mining*, *Vital Mining*, *Hazelwood Resources* and *Venture Minerals.*

References: Proactive Investors, 2015. Wolf Minerals' English tungsten mine start-up is on-track. In Proactive investors Australia. Date of consultation: 27/02/2015. Available on: http://www.proactiveinvestors.com.au/companies/news/60864/wolf-minerals-englishtungsten-mine-start-up-is-on-track-60864.html
CLARK R., 2015. Wolf Minerals Limited. In: Investor Roadshow, 23/02/2015, United Kingdom. Presentation available on site: http://www.wolfminerals.com.au/IRM/Company/ShowPage.aspx/

Benoit DUCELLIER

Primary and secondary niobium mineral deposits associated with carbonatites

Roger H. Mitchell, 2014

The most critical problem in mine design is mining method selection. It has a significant influence on the all of the mine decision making problems. It depends on some parameters such as geotechnical and geological features and economic and geographic factors including shape, thickness, depth, slope, RMR and RSS of the orebody, RMR and RSS of the hanging wall and footwall. To calculate the priorities of factors and select the best mining method for Qapiliq salt mine in Iran, fuzzy analytical hierarchy process (AHP) technique is used. They calculated polls, slope and weight vector by eigenvector method based on the geometric mean of the results of the expert's viewpoint for each method. After a comparison, between the four mining methods including area mining, room and pillar, cut and fill and stope and pillar methods, the stope and pillar mining method was selected as the most suitable method to this mine.

References: Primary and secondary niobium mineral deposits associated with carbonatites, Roger H. Mitchell, SciencesDirect, 2014.

Laurie MALHEIRO

Le système porphyrique à molybdène de Tilly

B. Chapon, M. Jébrak, P.-S. Ross, R. Stevenson, 2010

This survey, called "project DIVEX", consists of mineralization descriptions and characterization of the molybdenium porphyry system of Tilly wich is located in la Baie James (Québec).This archean complex presents 4 zonations: the north is characterized by a contact between two plutonic intrusions of tonalite-granodiorite and diorite, the east by clastic-sediments and the south by volcanoclastic deposits. Many irregular and porphyry dikes intrusions have been highlighted describing a calc-alkaline geochemistry from an arc environment.

The molybdenium source is part of 0.2 m to 2 m long hydrothermal breccias formed by hydraulic fracturing into plutonic intrusions and porphyry veins. It appears as stockwerks, lenses or scattered in association with pyrite, chalcopyrite, bornite, chalcocite and quartz. Weathering shows alkaline features described by biotite, K-feldspaths and high percentage of hematite. This complex has been dated at 2745.8 +/- 0.8 ka, corresponding to neo-archean, by U-Pb methods on Zircon.

References: B. Chapon, M. Jébrak, P.-S. Ross, R. Stevenson, 2010. Le système porphyrique à molybdène de Tilly. Sous projet SC36, Divex, Diversification de l'exploration minérale au Québec.

Erika DÖRING

Potential mining of lithium, beryllium and strontium from oilfield wastewater after enrichment in constructed wetlands and ponds

SCHALLER J., HEADLEY T., PRINGENT S., BREUER R., 2014

Oil drilling and extraction produce high amounts of water, wasted after oil separation. This water, known as “produced water”, often contain high quantities of chemical elements.

In some cases, where the climate is mainly arid, companies take care of this water with the use of constructed wetlands, to purify the water with plants before reusing it and lastly letting it evaporate. The idea of this publication was to check if the salts left by evaporation of produced water could contain economic concentrations of rare metals or rare earth elements.

Samples were taken and analysed from evaporation bonds within the oil exploitation of the company BAUER, in the south-eastern of the Arabian Peninsula, at different stages of the circuit. The concentrations were multiplied by the amount of water inflow expected over the next 20 years of operation.

The highest amounts of element to be potentially harvested were calculated for magnesium and calcium, but regarding their low price a harvest by wetland would be meaningless. However, the amounts of lithium and beryllium were more interesting, with respectively 6.6 tons a year and 2.9 tons a year. The harvestable amount of beryllium and lithium after 20 year is comparable with a thousandth of the global production of rare earth elements per year, with this extraction site alone. Based on the current prices ($4,500/ton and $3,100/ton respectively), it represents $590,000 for the lithium and $180,000 for the beryllium within 20 years of operation, and they can be easily harvested from the salt fields of the evaporation ponds.

References : SCHALLER J., HEADLEY T., PRINGENT S., BREUER R., 2014. Potential mining of lithium, beryllium and strontium from oilfield wastewater after enrichment in constructed wetlands and ponds. Science of the Total Environment 493 (2014) 910–913, available at www.sciencedirect.com.

Antoine MILLOT

Nyrstar récupère un métal rare dans les déchets de raffinerie

Buyse N., 2012

Indium is a rare metal which is mainly in demand in modern electronics in semiconductors compounds but especially in thin-film coatings. Belgium firm Nyrstar was the first European producer and the only one French producer of indium.

With the zinc market crisis in the mid-2000s, the Nyrstar refinery in Auby (France) brushed closing in 2005 with a dramatically decrease of activity. So the firm were seeking diversification. The key was on the optimization of wastes from the production of zinc. Indeed, in one tonne of zinc there are 10 to 500 grams of indium.

So with an important investment, Nyrstar develop a technique for extracting a “by-product” of zinc containing 20% of indium. In 2012, thanks to a second investment, the Auby site has implemented another method to obtain almost pure metal. As a result of this activity, very profitable, Nyrstar produced 5% of world production of indium in 2012.

To continue on the way of economical waste recycling, Nyrstar envisages to settle projects on production of germanium.

References: Buyse N., 2012. « Nyrstar récupère un métal rare dans les déchets de raffinerie. » Les Echos. LesEchos.fr, February 2012. Online information:
http://www.lesechos.fr/thema/0203979367786-nyrstar-recupere-un-metal-rare-dans-les-dechets-de-raffinerie-1070364.php

Camille CHEREAU

Graphite and rare earth metals for the 21st Century: Jack Lifton

The Critical Metals Report, 2012

Graphite is considerate as a metal "strategic" and declared as a supply-critical mineral by both the United States and the European Union, but it is the population growing and rising living standards in developing countries that are driving demand for most raw materials. This article is an exclusive interview with The Critical Metals Report, Institute for the Analysis of Global Security Senior Fellow Jack Lifton. This article lists the main sectors of activity where you can find graphite, as well as new applications, the specific use of graphene, but also the world's reserves, and other relevant factors. There is also, the traditional demand for graphite in the steel and automotive industries that is growing 5% annually, and since 2005 prices have basically tripled, and supply is tight. Production has held steady at approximately 1.1 million tons (Mt) as China (over 70% of world production) appears to have reached the limit of its productive capacity and the commodity super cycle has soaked up excess supply. Graphite mining and processing is currently limited to a small handful of countries, with China and India for example. With demand for graphite growing at 50% per year and prices reaching $2,500-3,000 a ton, the future for graphite companies with actual projects is excellent. These traditional industrial users will find themselves competing for supply with those producing new technologies as there are very few economically feasible alternatives and little recycling of graphite. This booming demand will require more than a doubling of current global graphite production to meet the needs of traditional markets as well as such emerging markets.

References: The Critical Metals Report, 2012. Graphite and rare earth metals for the 21st Century: Jack Lifton. [On the Web]. Available on : Mining.com
http://www.mining.com/graphite-and-rare-earth-metals-for-the-21st-century-jack-lifton/

Emilie GALHAUT

Recovery of rare earths from weathered crust elution-deposited rare earth ore without ammonia-nitrogen pollution: I. leaching with magnesium sulfate

Xiao Yanfei, Feng Zongyu, Huang Xiaowei, Huang Li, Chen Yingying, Wang Liangshi, Long Zhiqi, 2015

The world's main source of Mid-Heavy Rare Earth Elements is the leaching of the mining tails in China, the usual processes (flotation, magnetic and such being utterly inefficients). The efficiency being the main worry when mining began, the $(NH_4)_2SO_4$ in-situ leaching process was used extensively. However, it revealed serious environmental issues, such as the pollution of surrounding water bodies and alteration in plants growth. The aim for this study was to study the efficiency of a magnesium sulfates solution for leaching processes, and to determine kinetic model of the reaction.

It came out that the magnesium sulfate solution would reach a 93% leaching efficiency with a flow rate of 0.60mL.min^{-1}, 0.20mol.L^{-1} magnesium sulfate solution, a pH of 5.70, and a collected volume of 300mL for a temperature of 298K. The aluminium leaching efficiency only reaches 50%. Out of the three tested kinetic models, the closest to the experimental data is a Pseudo-first-order model, with liquid diffusion being identified as the main mechanism. The apparent activation energy is 8.90kJ.mol^{-1}.

However, this kind of solution would result in highly magnesium-enriched soils, which would be too rich for plants, as they require a balance between magnesium and calcium. Hence, the next step in those researches is the mix between Magnesium salts and Calcium salts.

Yanfei X., Zongyu F., Xiaowei H, Li H., Yingying C., Liangshi W., Zhiqi L., 2015. Recovery of rare earths from weathered crust elution-deposited rare earth ore without ammonia-nitrogen pollution: I. leaching with magnesium sulfate, Hydrometallurgy, volume 153, p58-65

John-Lee DUBOS

Un procédé « écologique » et « économique » pour recycler le Gallium

ENERZINE, 2013

Le gallium est un métal critique, utilisé dans les LEDs comme composant émetteur de lumière, ou encore dans les cellules photovoltaïques CIGS (cuivre, indium, gallium, sélénium) comme matériau semi-conducteur. Ces cellules sont considérées comme l'avenir du photovoltaïque, c'est pourquoi la demande mondiale de gallium devrait considérablement augmenter dans les prochaines années. C'est pourquoi la filiale « Materials » du groupe Mitsubishi a cherché à développer une technologie capable de mieux recycler ce métal, à partir de déchets, par un procédé peu coûteux et entrainant une pollution moindre. En effet, la solution consiste en une fusion « sèche » et « humide », qui permet d'extraire le gallium sans être obligé de fondre la totalité des déchets. Dans la méthode standard de recyclage du gallium, tous les déchets sont fondus par solution chimique. La quantité de solution chimique utilisée dans la méthode de la société Mitsubishi est alors considérablement réduite, diminuant l'impact environnemental du recyclage. Grâce à cette méthode, environ 99,99% du gallium recyclé peut à nouveau être purifié.

References : ENERZINE, 2013. Un procédé « écologique » et « économique » pour recycler le Gallium [en ligne]. Disponible sur : http://www.enerzine.com/604/15127+un-procede-ecologique-et-economique-pour-recycler-le-gallium+.html

Philippe BOITIAU

Platinum-group element mineralogy and geochemistry of chromitite of the Kluchevskoy ophiolite complex, central Urals (Russia)

F. Zaccarini, E. Pushkarev, G. Garuti, 2006

This article reports the results of investigation of chromitites occurring in the Kluchevskoy ophiolite complex of the Russian Urals. The investigated chromitites are enriched in Os–Ir–Ru over Rh–Pt–Pd, as typical of the mantle hosted ophiolite chromitites. Consistent with the geochemical data, the Platinum Group Mineral (PGM) assemblage is dominated by Ru–Os–Ir phases, whilst specific Rh–Pt–Pd minerals are absent. Two distinct paragenetic assemblages have been recognized: 1) primary magmatic PGM (laurite, erlichmanite, osmium, iridium, unnamed Ir–Ni–S, cuproiridsite, irarsite and ruthenarsenite) and 2) secondary PGM formed by desulfurization of primary sulfides at low temperature (ruthenium). Comparison of the studied chromitites with those hosted in the mantle of the Kempirsai, Ray–Iz and Voikar–Sininsky ophiolites has shown that all these chromite deposits form in the same geodynamic environment. The differences in the temperature calculated on the Fe–Mg exchange between olivine–spinel and observed in the PGM assemblage suggest that the Kluchevskoy chromitite suffered the effects of the metasomatism to a lesser extent compared with Kempirsai and Ray–Iz chromitites.

References : F. Zaccarini, E. Pushkarev, G. Garuti , 2006. Platinum-group element mineralogy and geochemistry of chromitite of the Kluchevskoy ophiolite complex, central Urals (Russia). Ore Geology Reviews. Volume 33, Issue 1, January 2008, Pages 20–30. Special Issue on Ore-forming Processes associated with Mafic and Ultramafic Rocks.