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Contenu

Phosphate Carbonated Wastes Used as Drains for Acidic Mine Drainage Passive Treatment: Abstract.

Omar Ouakibi, Rachid Hakkou and Mostafa. Benzaazoua

This abstract resume the study of Omar Ouakibi, Rachid Hakkou and Mostafa Benzaazoua focused on the removal of heavy metals from a synthetic acid mine water by using continuous column experiments and Phosphate carbonated Wastes as alkaline drains. Tests have been made from passive treatment system to neutralize the acid mine drainage (AMD) containing high concentrations of dissolved iron and other metals. A serie of experiments were conducted for the passive treatment of a pH 3 synthetic AMD solution containing 600 mg/L Fe, 4 g/L SO4, 350 mg/L Ca, 160 mg/L Al, 20 mg/L Mn, 15 mg/L Zn, 23 mg/L Cu, and traces of Co, Cr, and Ni. The tests were performed under anoxic and oxic conditions to estimate the more efficient condition. Test were performed in columns tests with a hydraulic retention time of 15 h. The pH increased from 3 to values between 6.5 and 8. The results also showed that the neutralization capacity under oxic conditions is higher than under anoxic conditions. This study focused first on the AMD treatment compare also the efficiency of the treatment conditions.

Literature :

Omar Ouakibi, Rachid Hakkou and Mostafa. Benzaazoua, 2014. Phosphate Carbonated Wastes Used as Drains for Acidic Mine Drainage Passive Treatment. Procedia Engineering 83 (2014) 407 – 414.

Alexandre PAYET

Abstract of the paper: “The Lamandau IOCG deposit, southwestern Kalimantan Island, Indonesia: Evidence for its formation from geochronology, mineralogy, and petrogenesis of igneous host rocks »

Shuang Li, Xiaoyong Yang, Weidong Sun, *ScienceDirect*, 2014.

The Lamandau region of Kalimantan Island in Indonesia is located in Sandaland, in the southern part of the Kuching tectonic belt. In the Kuching belt, there are series of Cenozoic epithermal gold deposits and Fe–Cu–Au deposits. The Lamandau Fe–Cu–Au deposit is hosted by diorite porphyry. In-situ zircon U–Pb dating of the diorite porphyry shows that it formed between 82.1 ± 1.7 Ma and 78.7 ± 2.3 Ma. The sub-chondritic Nb/Ta ratios for the basalt in the Lamandau region indicate that the subducted Pacific slab began partial melting at depths where amphibole was the major residual phase, with some residual rutile. The basalt was derived from a depleted mantle source. The composition of apatite and zircon in the diorite porphyry indicates that the dioritic magma was produced from the subcontinental mantle after it was metasomatized by slab-derived fluids. So it can be said that the ore-related diorite porphyry in the Lamandau region might have formed in an extensional environment during rollback of the subducting western Pacific plate. The convergent velocity between the Philippine Sea and Eurasian plates was at a minimum during the rollback, so that the margin of East Asian began to undergo rifting with associated magmatism.

Laurie MALHEIRO

Prediction of the shrinkage behavior of recycled aggregate concrete: A review

R.V. Silva, J. de Brito, R.K. Dhir (in Science Direct, Construction and Building Materials, Volume 77, 15 February 2015, Pages 327–339)

The global market for construction aggregates is expected to increase. According to Eurostat, the total amount generated in the EU, in 2010, was almost 860 million tonnes of construction and demolition activities. The increasing and unsustainable consumption of natural resources, along with the excessive production of construction and demolition wastes, has been the cause of great concern for the environment and the economy. In order to reverse this trend, there have been several efforts to promote the ecological efficiency in the construction industry, one of them being the reutilization in new constructions. By doing so, besides decreasing the amount of waste mass sent to landfills and the impacts of the extraction of natural resources, more value will be added to these materials, thus opening new market opportunities. Bearing this in mind, the use of recycled aggregates (RA) as replacement for natural aggregates (NA) in the production of concrete has been considered as one of the most salubrious approaches for recycling certain materials and thus contribute to greater sustainability in construction. Indeed, extensive scientific research and development work on this subject has been carried out over the last 40 years (size, origin, mixing procedure, curing conditions, use of chemical admixtures and additions), some of which has concentrated on observing how the use of RA might influence the performance of structural concrete.

Emilie GALHAUT

Early Silicate Earth Differentiation, from CARO, G. 2011. Annual Rev. Earth Planet Sci., 39:31-58 Annual Reviews.

This articles talks about how the study of small isotopic anomalies in Hadean silicate reservoirs can give information on early mantle-crust differentiation at the early stages of Earth's formation where almost all information has been erased from the geological record. Information on these now vanished Hadean reservoirs is given to us through inclusions in ancient Archean rocks which have sampled and preserved them. The Sm-Nd isotopic system is used to date characterize the early events of Earth's formation.

Two chronometers are used: a ^{147}Sm - ^{143}Nd long lived chronometer with a half-life of 103 Ga giving information on mantle-crust system evolution over the past 4.5 Ga and a ^{146}Sm (now extinct) - ^{142}Nd short-lived chronometer with a half-life of 106 Ma giving information on events occurring older than 4.2 Ga. The ^{147}Sm - ^{143}Nd is normalized by the reference ratio of the chondritic composition (CHUR). As for the ^{146}Sm – ^{142}Nd, normalization is done using terrestrial standards so that current mantle and crust have $\varepsilon_{142}Nd = 0$. Both Sm and Nd are refractory and lithophilic elements. Sm/Nd fractionation takes place during partial melting and fractional crystallization linked to crustal formation and differentiation. These elements are both incompatible (Nd is more incompatible due to its larger ionic radius) and are therefore present in larger quantities in depleted mantle than crustal reservoirs.

Early observations using the ^{147}Sm - ^{143}Nd system state that bulk silicate Earth (BSE) had perfectly chondritic Sm/Nd and $^{143}Nd/^{144}Nd$ ratios because they were not affected by cosmochemical fractionation. New observations contradict past mantle-crust evolution models. One of these observations calls for an early depletion of Earth's mantle prior to the onset of continental growth (> 4 Ga). Many different models are also assumed but they all converge to

one common feature that is the creation of long-lived enriched reservoirs in the Earth's early evolution.

^{142}Nd composition studies in the past showed that immediately following accretion, the earth experienced global differentiation. More precise mass spectrometer studies have later shown this model wrong. When coupled ^{142,143}Nd systematics are considered, it appears that early Archean mantle did not uniformly deplete, but that there are 2 distinct reservoirs accounting for heterogeneities in early Archean rocks. One is derived from a depleted reservoir as the other is extracted from a primitive reservoir. The isochron therefore shows that earth's mantle was differentiated at around 4.39-4.42 Ga. The assumption of perfectly chondritic bulk Earth is no longer justified.

Speculative interpretation of ^{146,147}Sm – ^{142,143}Nd chronological constraints lead to two possible mantle differentiation models. The first scenario deals with the crystallization of a deep magma ocean. Crystallization of Mg-Perovskite in lower mantle and majorite and olivine in upper mantle would have created a residual liquid enriched in incompatible elements. Crystallization of this liquid would have occurred at a later stage. This can be seen the mixing of deep primitive mantle with shallow depleted reservoirs enriched in incompatible elements. The second scenario considers that early mantle was due to continental growth rather than the crystallization of a magma ocean (previous scenario). The study of Jack Hills zircons resulted in the suggestion of granite generating zones creating continental mass as early as 4.5 Ga.

Matthieu CAEKAERT

50-Ma Initiation of Hawaiian-Emperor Bend Records Major Change in Pacific Plate Motion

Introduction:

The Hawaiian-Emperor chain, consisting of 129 volcanoes stretching out over 6000 km in the northern Pacific basin, has played a big role in understanding Pacific plate motions. This article proposes new ages for the central and southern Emperor chains. These ages coincide with large scale Pacific plate tectonics events which leads these scientist to reinterpret the formation of the chain of volcanoes.

Methods:

Rocks were dated using 40Ar/39Ar on pieces of drill core via broad-beam laser incremental heating applied to plagioclase, anorthoclase, and amphibole (little to no alteration). Paleomagnetic data was also used to date and study Pacific plate motion and link these events to the formation of the Emperor chain.

Results:

New ages for Hawaiian-Emperor volcanoes confirm a steady increase in age along the chain even if the migration ages vary. This monotonic advance in age is unique to this volcano chain in the Pacific. Volcanic migration increases along the Emperor seamounts, slowed north of the HEB and uniform beyond it. These variable motions indicate that Pacific plate and hot spot motion must've been directed along the trend of the chain. This also means that the HEB couldn't have been formed by slowing of the hot spot, as it was previously assumed. Also, rate of volcanic migration did not show signs of slower southward motion but were constant within the data set.

It was previously accepted that the HEB formed at 43 Ma, but new 40Ar/39Ar dates indicate older ages. The new age for HEB initiation is 50 Ma, which coincides with major reorganization of northern

Pacific spreading centers. At around this time, magmatism in the Izu-Bonin-Mariana (IBM) arc systems on the western edge of the Pacific Plate started. Geological relations show that IBM arcs originated by nucleation of subduction along northerly trending fracture or transform zones, which implies that a major shift in Pacific plate motion. The Pacific plate would have become more westerly, which is consistent with the track of the Hawaiian-Emperor chain after the bend.
It was previously thought that Pacific plate motion was too rapid to be caused by buoyancy forces due to mantle convection from the slab pull, but the time scale for HEB evolution had not been resolved in the past. HEB formation lasted over 8 Ma and was therefore slower than what was previously accepted.
The geometry, age and tempo of Hawaiian-Emperor Bend in therefore consistent with Pacific plate motion. This motion was caused by subduction of arcs in the western Pacific in the early Eocene. A remaining question concerns that forces that initiated the IBM subduction. The straight track of the Hawaiian-Emperor chain leads us to think that the forces have not changed the direction of Pacific plate motion. It would therefore be useful to look for motion in adjoining Eurasian or Australian plates so seek the cause of this convergence. A possible cause of this convergence is the collision of India and Eurasia at around the same time (50 Ma).

Matthieu CAEKAERT

Artisanal mining in Burkina Faso:

This article written by Kim A.A Hein and Todani A.Funyufunyu is published by The Extractives Industries and Society in May 2014. It deals with how the mining industry extract mineral for hundreds years in Burkina Faso. Indeed, in sub-Saharan Africa, artisanal and small-scale mining (ASM) has changed very little for hundreds of years and today is the most important economic activity in many of the region's rural communities.

In the west of the village of Dem in Burkina Faso, a history of extraction, processing and smelting of iron ore is recorded in 3 opencast mines, 2 underground mines, waste dumps, processing sites, and 11 furnaces that host fragments of furnace wall clay, tuyeres, and rare crucibles. At the Dem site, they extract selectively magnetite-hematite primary ore from fractures in quartz veins, and secondary hematite-goethite ore in iron-rich ferricrete and that ore is smelted in furnaces to produce iron metal. This study has attempted to uncover the historic extraction, processing and production of iron ore. Because the exploration and mining history are arguably lost, the extraction techniques are not known, the reasons for production have been forgotten and the age of mine workings is no longer known, this research recorded the size and dimensions of the mine sites, waste sites, orebody and furnaces. It recorded the techniques used as best could be interpreted from the site, and studied the metallurgy of slag and type of ore deposit, while constraining the geological setting of the iron ore deposits.

In any event, the Dem site shows evidence of an African society at work with skills in metal extraction, production and forging technology (pyrometallurgy). These skills must have included: (1) exploration for iron resources and recognition of reservable iron ore grades, (2) mining methodologies both in underground and open cast mining, (3) ore processing techniques and refining practice, and (4) smelting and beneficiation of iron ore. There is evidence of a mining value chain. The Dem ASM site should therefore be protected and preserved as a geological, mining and cultural monument by the relevant authorities in Burkina Faso at the state and provincial levels. This will prevent degradation and destruction of the heritage, and consequently preserve the values and history of the area for present and future generations in sub-Saharan Africa.

Quentin CORNUEL

Metal-Eating Bacteria for Asteroid Mining

Bio-mining is already known as a tool to site decontamination and more recently as a sustainable alternative to ore and waste processing, especially in gold, copper, zinc and nickel extraction. Biomining
could also be used in the future for space mining. That's the purpose of the study conducted by the firm Deep Space Industries which is planning to mine extra-terrestrial bodies as asteroids and even moon. By the injection of bioengineered bacteria into asteroids, Deep Space Industries expects to obtain 10 to 20 years later economical mineable preprocessed materials and hope to extract rare metal as palladium and platinum. The project plans to launch a mothership carrying a dozen of 6 inch sized cube-shaped spaceships (CubeSat) which will inject the bacteria into the asteroid. Currently targeted asteroid consist in near-Earth asteroids of which 2800 appear to be potentially habitable with an interior temperature comprised between -5 and 100 °C. Moreover 120 appear to have an interior temperature from 15 to 45 °C, optimum for bacterial productivity. Now, the study focuses on the ability of bacteria of living in a vacuum environment. Deep Space Industries could launch its first mothership within three or four years and estimates full-on asteroid mining will be carried out in 15-20 years. Deep Space Industries is one of the two main asteroids mining companies, the second one is Planetary Resources Inc.

Read Articles:

http://www.mining.com/here-is-why-metal-eating-bacteria-may-make-asteroid-mining-profitable-43509/

http://www.space.com/28320-asteroid-mining-bacteria-microbes.html

Further information about asteroids mining:

http://www.space.com/15391-asteroid-mining-space-planetary-resources-infographic.html

Benoit DUCELLIER

New Gold Project in Mongolia?

On the January 23rd, 2015, the Toronto-based mining company Centerra Gold Inc. announced its Gatsuurt Project has been designated as a mineral deposit of strategic importance by the Mongolian Parliament. At December 31, 2013, the mineral reserves were estimated at 17.1 million tons at an average grade of 2.9 g/t containing 1.6 million ounces of gold with a cut-off grade of 1.4 g/t. The interest by the Mongolian Parliament for the Gatsuurt project resides in the possibility for the government to acquire up to 34% in the venture. The site of Gatsuurt is located 35 km away from the Boroo mine which has been exploited for 10 years. Centerra Gold Inc. expects to mine the ore of Gattsuurt and to process it in Boroo's installations. During the first two and half year, 3.6 million tonnes of ore at a grade of 2.86 g/t will be processed by CIP (Carbon-in-Pulp) and then the 13.5 million remaining tonnes at a grade of 2.92 g/t will be processed by BIOX (Biooxidation). The last designation represents a further step toward the development of the Gatsuurt project. The next step consists of the request for approvals from the government. However, the project is already contested because of its environmental impact and because of the presence of precious iconic burials. Centerra Gold is the biggest Western-based gold producer operating in Central Asia.

Read Article and associated announce of Centerra Gold

http://www.mining.com/centerra-a-step-closer-to-moving-gold-project-in-mongolia-forward-63999/

http://www.centerragold.com/sites/default/files/news-releases-en/gatsuurtstrategic_final_23jan2015.pdf
About BIOX process:
http://www.chemicalbulletin.ro/admin/articole/59880art_57(237-240).pdf
About CIP process :
http://saimm.co.za/Journal/v099n01p013.pdf

Benoit DUCELLIER

Article abstract: Early Silicate Earth Differentiation, from CARO, G. 2011. Annual Rev. Earth Planet Sci., 39:31-58 Annual Reviews.

This article is about the utilization of the Sm-Nd isotopic systems for a better understanding of the early Earth differentiation processes. By using the anomalies of the short-lived chronometer which is 142Nd, the author compares old and more recent models to precise the very early history of Earth.

Two different isotopic systems involving Sm and Nd has been used: 147Sm decaying to 143Nd with a half-life of 103 Gy, and 146Sm which decays into 142Nd for a half-life of 106 My. Ratio calculations for the two systems (147Sm-143Nd & 146Sm-142Nd) has been respectively normalized by the chondritic uniform reservoir (CHUR) ratio and a terrestrial standard in which ε142Nd = 0.

Pioneering investigations have shown that ε143Nd values in Proterozoic rocks were as expected for a primitive magma, and thus like the Sm/Nd ratios observed in chondrites. As a result, it has been previously though that Earth's mantle has not been early differentiated. It was later determined that these conclusions are not valid regarding the bulk terrestrial composition. Although, several different models of early differentiation has then been built, they can be all gathered under one common feature: Long-lived rich reservoirs should have been created at the very beginning of Earth's story.

A first use of both Sm-Nd systems coupled has led to the idea that Earth's mantle has been immediately differentiated once accretion has ended. Finally, recent analyses thanks to more precise mass spectrometer has shown that this conjecture is probably wrong. Even if the Archean mantle seems to have uniformly depleted - regarding ε146Nd signatures in rocks older than 2.5 Ga – early Archean rocks appears to be issued from different reservoirs. One corresponds to a depleted mantle while the second is a primitive chrondritic-like reservoir. In any case, an isochron based on several Archean rocks 142,143Nd data indicates that Earth's mantle differentiation started 4.42-4.39 Gy ago.

Two distinct scenarios are plausible to explain the very early Earth's differentiation. One is based on the 146,147Sm - 142,143Nd isotopic systems and suggests that the crystallization of a deep magma ocean, in two stages, is at the origin of Earth's mantle early differentiation. This scenario consists in the depletion of shallow reservoirs by crystallizing primary minerals (such as perovskite and olivine) and creating an incompatible element enriched residual liquid.

On the other hand, studies has been done on the Hadean zircons found in the Jack Hills formation. Those zircons appears to have crystallized from hydrous and peraluminous magmas, derived from crustal reservoirs. The use of Lu/Hf system has proved that this crustal reservoirs have been extracted from the mantle 4.5 Gy ago. Then, the conjecture is that continental masses such as the ones containing Jack Hills zircons could have formed an early differentiated crust, responsible for the differentiation of Earth's mantle.

Rémi CLAIRET

Article abstract: 50-Ma Initiation of Hawaiian-Emperor Bend Records Major Change in Pacific Plate Motion, from SHARP, W. *& CLAGUE, A.-D.,* 2006. Sciencemag, Vol. 313.

This article talks about a change in the model for the Hawaiian-Emperor Bend (HEB). The Hawaiian-Emperor Chain (HEC) is made of 129 volcanoes and exhibits a bend at the middle of chain, which was previously allocated to a slowing down of the Pacific plate motion

As the HEC is a perfect example of fixed hot spot while the oceanic plate should be moving, some evidences of a Pacific Plate shift at 43 Ma ago must be found. Yet no such features has been identified, so that the authors has started to consider that either the previously admitted age of the HEB formation or the Pacific Plate motion model should be re-think. According to paleomagnetic data, it has been previously settled that the Hawaiian hot stop could have been fixed just after a rapidly moving southward event. In the same way, Pacific Plate motion changes are also suggested by global plate circuits.

Because the old conventional K-Ar and Ar-Ar dating methods used whole rock samples, they were not reliable. Thus, the authors made further analyses with modern and improved mass spectrometer, such as broad-beam laser incremental heating instruments, on plagioclase, anorthoclase and amphibole notably. The isotopic system used is still the 40Ar/39Ar. The main advantage of analyzing single minerals is that the dating accuracy is preserved even of highly altered rocks. The dating has been realized on shield and postshield lavas notably. Usually, such magmatism events for the Hawaiian Islands last 1 million years. Considering that this seamount chain could have been the result of a slower plate motion, the authors assumed that the lavas have been erupting for 2 million years at each volcano. Because the drilling could only have reached the half of the lavas thickness, and thus the most recent rocks, 1 million year of uncertainty has been attributed for shield and postshield age measurements.

The new ages have shown that the migration rates are increasing from the very north of the HEC (Detroit) and values lower than 5 cm/year, till the north of the HEB (North Koko) where the migration rate is up to 17 cm/year. From the south of the HEB to the Hawaiian Islands, these rates remain more monotonic and relatively weak, varying from 4.6 to 6.5 cm/year. Such variations indicate that the Pacific plate and hot spot motions were likely to be parallel to the trend of the chain. Hence, and unlike it was previously considered, the HEB is not the result of a hot spot motion speed reduction. Although a 43 Ma age for the HEB was accepted so far, the new Ar-Ar datation, correlated with regional and local geological settings, revealed that HEB formation has been initiated 50 Ma ago. On top of that, these recent analyses stated that the HEB formation could have lasted a few million years.

These new age parameters have led the authors to think that the HEB is linked to Izu-Bonin-Mariana (IBM) arc activity. The IBM subduction is probably at the origin of a large-scale shift in the Pacific plate motion. Such a reorganization could have make the Pacific plate motion more westerly, which can logically explain the HEB shape. This shift has been previously stated older than the HEB formation, but the results from improved and more recent datation methods brought evidences that these two tectonic features are contemporary. The authors also think that the Tonga-Kermadec arc behavior could have an influence of the Pacific plate motion changes. According to their words, IBM activity as well as other plate tectonic events in the Pacific are likely to be the initiated by the India-Eurasia collision or even by the convergence between the Australian and Pacific plates.

Rémi CLAIRET

"Sherritt makes big move on US-Cuba deal"; www.mining.com, Andrew Topf, 21/12/2014.

Following US-Cuba "reconciliation" declaration, the company Sherritt International saw a whopping 42.9 percent gain in 4 days. Barak Obama called for an end to the economic embargo against Cuba which for 50 years compels Cuban economy and it has been felt in political climate.

For Cuba's largest foreign investor, mining and energy firms, Sherritt will serve of test model to see how the removing of the embargo will affect foreign firms doing business in Cuba. Indeed, the natural resources company has oil and gas operations in Cuba and cobalt and nickel mines, a joint venture between subsidiaries of Sherritt and General Nickel Company S.A.

To conclude, Sherritt's CEO said this agreement would make it easier for selling processed nickel and cobalt and buying the stock for US customers. Furthermore, it alleviates the political risk and permits to extend the production life of energy firms in Cuba. Actually, Sherritt is the most important independent oil producer in Cuba and it recently operates through Production Sharing Contracts (PSCs) with the Cuban government, which is significant for the business strategy of the firm.

Camille CHEREAU

First data on platinum group elements (PGE) geochemisty of the Mont Albert peridotites (Quebec)

Khalid Gueddari, Marc R. La Fkche, Genevike Camireb

The Mont-Albert is located in the northeastern part of the Quebec Appalachians. Ultrabasic massif, it can be considered as an incomplete ophiolite remnant composed of pyroxene in low lherzolites, harzburgites, and in smaller proportions of dunite and olivines' orthopyroxènites. The study stands as a first geochemical characterization of levels of PGE (platinum group elements) and copper in this field. For this, only few serpentinized peridotites have been taken into account.

After analysis of the major elements, rare earth and EGP, it appears that copper levels are abnormally high, and indicate that the peridotites from Mont Albert differ from other massifs such as Ronda (Spain) and Beni Bousera (Morocco) . The PGE contents are similar to those of Ronda and Beni Bousera.

The study corroborates the fact that PGE are inert during serpentinization. The lack of correlation between the levels of Cu and the degree of serpentinization suggests that these levels are primary. PGE and copper could be associated with sulphide phases, prior to the partial melting process.

Quentin GUELENNOC

Channel characterization using multiple-point geostatistics, neural network, and modern analogy: A case study from a carbonate reservoir, southwest Iran.

Seyyedhossein Hashemi, Abdolrahim Javaherian, Majid Ataee-pour, Pejman Tahmasebi, Hossein Khoshdel, 2014

This article reports about the multiple-point geostatistics method (MPS) used to characterize a carbonate oil field located at the South-West of Iran. This type of modelisation is the best one to modelize the delineations of curvilinear geological features, facies variations and reservoir heterogeneities. The first stage of the MPS method is the creation of Training Images (TI) that are based on non-stationary aerial images and represent the geological features and their facies. The modern occurrences and the sequence stratigraphic analysis allowed the creation of a database gathering all the possible channel shapes of the area thus the geological facies usually deposited in this type of area. Then a neural network analysis calculates the facies probability and imported it as soft data. Finally the SNESIM (single normal equation simulation) implements the MPS to generate facies simulation. The entire TI is scanned once to create the search tree corresponding. All the template patterns are stored and probabilities calculated under trees. The Tau equation is the combination of the probabilities of the MPS method and the one from neural network analysis. In opposite to other algorithms, the Tau one allows to control the development of the facies and reproduce facies shape in accordance with the geologist expectations. The main drawback of the MPS method is the huge amount of RAM taken to store the search patterns and trees. The method is also very slow because CPU can't deal with a large area and numerous facies. For that Straubhaar et al, 2013 proposed the idea of storing the search events into index lists instead of trees. The leaves of the trees would be individual sublists (partition of entire lists). Mariethoz et al, 2010 overcome the SNESIM limitation in sampling directly the TI into data so that they won't be any scanning database.

Marine DELESALLE

A balancing act: The role of benefits, impacts and confidence in governance in predicting acceptance of mining in Australia

Airong Zhang , Kieren Moffat, 2015
Mineral Resources Flagship, Commonwealth Scientific and Industrial Research Organisation, CSIRO, Australia

Mining industry generate benefits through the exploitation of mineral resources but not without impact on societies and environment. This study aims to evaluate the benefits and the negative impacts of mining on the acceptance of this activity and how it affects the support of mining activities in Australia. A primary study appeared to reveal that when key impacts and benefits are considered together, the major factor of rejection is the mining's environmental impacts followed by the increase of the living costs implied by the reduction of agricultural lands. However mining activities bring employment to the region, promotes the mining community development, develop wealth and regional infrastructures leading to a better community's acceptance of mining. It remains that people don't want to compromise the environmental impact over the benefits of mining activities. A complementary study pointed out the central role of government and governance concerning the social reservations on the mining industry and about the expectation of how the industry operates. It seems that the confidence of the government holding the mining industry accountable reassured the population. Moreover the government has an important role of

moderating the mining's environment impacts. For that it is important to look at the social, psychological and theorical framework at the origin of the public acceptance of mining. Nowadays it is essential to understand the complexity of this issue regarding the future of mining development in Australia.

Marine DELESALLE

U–Pb geochronological constraints on the tectonothermal evolution of the Paleoproterozoic basement of Cadomia

La Hague, NW France, J.D. INGLIS, S.D. SAMSON, R.S. D'LEMOS, M. HAMILTON, 2004.
Available online *at www.sciencedirect.com*, Precambrian Research 134 (2004) 293-315.

The La Hague region is a place which provides the best outcrops of Precambrian basement's rocks in its segment of the Cadomian orogeny. They include orthogneiss, metasediments and metabasites, and they contain the same structures and metamorphic history.

Three main phases of deformation are identifiable within the basement units. The earliest (D1) gave rise to a flat lying gneissose foliation (S1) and was associated with localised migmatisation. Next was a period of NNE transpression, which resulted in deformation of D1 structures (D2), with foliation (S2) and lineation (L2). The NNE transpression continued (D3), and gave rise to semi-brittle sub-vertical zones, which overprinted early fabrics.

P–T conditions for the peak of D1 occurred under conditions of 700–800 °C and 8–9 kbar. Microstructural and field relations indicate that partial melting continued during D2 at decreasing pressures and elevated temperatures. Overprinting metamorphic textures and assemblages related record a retrograde event in greenschist facies deformation during D3.

U-Pb dating of zircons from the Culeron orthogneiss were made. The crystallisation age of the protolith is aged of 2061 $\pm$ 2.7 Ma. The overgrowths on the zircons, which could only happened during the anatexis with temperatures above 700 °C, are dated 618 Ma.

Antoine MILLOT

Monitoring residual mining subsidence of Nord/Pas-de-Calais coal basin from differential and Persistent Scatterer Interferometry (Northern France)

Y. Guéguen, B. Deffontaines B. Fruneau, M. Al Heib M. de Michele D. Raucoules, Y. Guise J. Planchenault

This geophysical report is about the coal basin situated in the Nord Pas de Calais, the aim of this study is what is the residual mining subsidence linked to the last coal mine of the Nord Pas de Calais coal basin. In Nord Pas de Calais, the extraction of underground resources was a considerable as 2.4 billion tons of coal during the last 270 years. So, the study want to know if actually there is a subsidence related with ancient coal mines.

The geophysical tools used to this study are Differential SAR Interferometry (DInSAR) and Persistent Scatterer Interferometry (PSI), these methods present a pluri-millimetric precision, which permit to see the subsidence.

The area of this study is situated in a coal basin, near to Henin-Beaumont, Courrières and Lens. The last mine of coal who close is situated in Lens, this mine closed on the 21st December, 1990.

Because of ancient mine, the study proves that there is three deformation phases during mining. The initial phase correspond to less than 15% of the total subsidence, after you have the fast main of subsidence which correspond to about 75% of the maximum subsidence percentage. And finally, there is the residual phase which may vary between 5 and 10% of the maximal subsidence percentage.

The results of this study show that the principal zones of displacements, localized in particular near the town of Courrières, Billy-Montigny and Lens. The interferogram indicates a subsidence of the cities between October 1992 and June 1995, with a maximum deformation of about 4cm on Courrières over this period. After 1996, we cannot observe any deformation signal on the Courrières area. So, the subsidence stopped or it can't be seen with DInSAR and PSI, so it's less than 0.3cm/year. In the area of Lens and Billy-Montigny still present small movements between 1996 and 1999, the subsidence initially 1.2cm/year for Lens and 0.8cm/year for Billy-Montigny.

To conclude, this study prove that there is a subsidence due to mines, during the first years after the end of the exploitation, subsidence continue.

Grégoire DEWEZ

The vast mineral resources of Mongolia hotly coveted

If the image is that of the Mongolian land ranchers and farmers, the country's resources actually reside more in his basement.

Indeed, the country, three times as big as France has huge open pit mines in the Gobi Desert. He rested enough coal to fuel the huge demand from China for another 50 years, but it also has large amounts of copper, gold, uranium and other minerals coveted by the world.

Therefore, Mongolia massively attracts foreign investors, Mongolia is under pressure from its neighbors: China and Russia.

The largest deposit is the Mongolian Talvan Tolgoi is the world's largest deposits of high quality coal with 7 billion tons of reserves, this mine located 200km from China feeds the Chinese steelmakers.

In 2011 China moved to Australia as a coal supplier for China.

The second Mongolian deposit, Oyu Tolgoi is a huge mine containing the world's largest reserves of copper and gold: 36 million tonnes of copper and 1,275 tonnes of gold according to estimates. This site is owned 66% by the Canadian group Ivanhoe and 34% by the Mongolian government. In 2013 it was designed to produce 450 000t copper and 10t of gold per year.

However, the race to exploit the subsoil is problematic, in addition to the pollution linked to the intense mining, the main issue appears to be the distribution of wealth produced. Indeed, mining accounts for a third of its GDP, but foreign investments benefit has 2.8 million Mongolian while others are enriched with colossal way.

The government has adopted a law limiting to 49% of foreign investment in three strategic areas: mines, banks and telecommunications.

Grégoire DEWEZ

Mineral chemistry of ore and hydrothermal alteration at the Sossego iron oxide–copper–gold deposit, Carajás Mineral Province, Brazil (source: ScienceDirect)

The Carajás Mineral Province takes place in the southeast part of the Amazon Craton in Pará State, Brazil. In this area, it contains the world's largest known concentration of large-tonnage iron oxide–copper–gold.

The Sossego iron oxide–copper–gold deposit in the Carajás Mineral Province comprises two major orebodies, Sequeirinho and Sossego.

We can find the sodic alteration with albite and hematite mineral and the sodic-calcic alteration with
albite, ferro-edenite/hastingsite , actinolite/magnesiohornblende, magnetite, titanite, epidote, and calcite.

The main alteration types that we can observe on the field are chloritization, magnetite bodies with envelopes of apatite-rich actinolitite were formed with the sodic–calcic event at high temperatures and potassic alteration with orthoclase and Cl-rich biotite.

For conclude, it's the phenomenon of Dilution and cooling of the hot metalliferous fluid by mixing with meteoric fluids may have been the main mechanisms responsible for the deposition of metals transported as metal chloride complexes in both orebodies of the Sossego deposit.

Matthieu COTTING

Recovery and separation of rare earth elements using salmon milt

Fish sperm could help for extracting and recycling rare earth elements from ore and materials such as magnets and electronic waste.

A japanese team led by Yoshio Takahashi discoverd that fish sperm (particularly salmons) or milt was a green and cheap alternative to chemical rare earths extraction methods. In those days, green methods for metal-extraction are more and more sought. The method is cheap, because every year, thousands of tonnes of milt is throw away.

Takahashi and his team noticed that the phosphate site of rare earths plays a crucial role in binding metals ions. DNA also has a phosphate site. It is from there that Takahashi thought to use DNA to extract rare earths in water. The problem was the DNA is soluble in water, so they had to fix cellulose (solid substrate that is insoluble) on DNA.

For testing salmon milt, the team created a milt powder and a solution with rare earths : neodynium and dysprosium. They observed that the metal ions had a high affinity for phosphate in the powder. To obtain the rare earths without the powder, acid and centrifugation are used.
The protocole is still in study, but it could work for recycle other types of metals.

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Philippe BOITIAU

"Structural evolution, metamorphism and restoration of the Arabian continental margin, Saih Hatat region, Oman Mountains"

M.P. Searle, C.J. Warren, D.J. Waters, R.R. Parrish

This article speaks about the evolution of the Arabian continental margin and the formation of Oman Mountains. First, the stable passive margin along the northern continental margin of Arabia was abruptly terminated during the Cenomanian. In this time, this argin collapsed and subsided rapidly to accommodate obduction of the Semail ophiolite complex. During the obduction, all structural units beneath the Muscat-Muttrah peridotite were metamorphosed at high-pressure (forming blueschist and eclogite, ca. 20 kbar) in a ductile deforming NE-dipping subduction zone, when thinned leading edge of the continental plate was subducted beneath the obducting Oman ophiolite. The present-day structure shows four SW-vergent thrust slices in caprolite grade rocks, overlying lower units of crosstie-bearing blueschist (Hulw unit). The largest zone separates 7-8kbar Hulw unit blueschists above from 12-15 kbar retrogressed eclogites and ca. 20kbar eclogites of the As Sifah unit below. Restoration of the entire Saih Hatat continental margin shows that the upper plate-Lower plate discontinuity cuts down-section to the SW as far as the Proterozoic Hatat schists. SW-directed exhumations of footwall HP rocks are consistent with a NE-directed extensional crenulation schistosity and NNE oriented stretching lineations in the eclogite and blueschist facies rocks. The NE facing shows many folds and spectacular sheath folds interpreted as antithetic backfolds with shortening in the upper plate balanced by the subduction of the lower plate. It's consistent with a NE-directed subduction of the continental margin rocks beneath the SW-obducting ophiolite, Haybi and Hawasina thrust sheets. New recent suggestions explain that SW-directed subduction beneath the Oman margin are not consistent with the sedimentary evolution of the shelf and slope carbonates of Saih Hatat. The first phase of tectonic uplift of Saih Hatat and Jebel Akhdar is the latest Cretaceous ramp culmination associated with foreland propagating thrusts in the SW and backfolds in the NE. the second phase consists of a post-late Eocene- Oligocene uplift by ca. 2000 meters.

Benjamin CHAILLOU

The tungsten isotopic composition of the Earth's mantle before the terminal bombardment.

Willbold M., Elliot T. & Moorbath S.

Problematic: Core formation occurs during accretion of the Earth and selects elements with preference for iron-melt over silicate-melt. But highly siderophile elements (HSE) are more abundant in the mantle than the core and suggest less fractionation than expected.

Methods: For the isolation of the W, two chromatographic separation techniques was used during the study for certify the results. Mass-spectrometric measurements were realized with a MC-ICPMS.

Summary: To answer this issue three models are suggested. The main hypothesis is a late veneer model, a late meteorite bombardment added on the Earth after core's formation which adduce a

final amount of meteorite material like HSE. But the late veneer model presents problems: the magnitude and the relative differences in the iron-silicate partition coefficients of HSE are lower than expected. Moreover, the modeling of the full range of HSE at high-temperature core is impossible. So they decide to study the 182W/184W ratio for determining the composition of the mantle before and after the terminal bombardment. Most of the rocks on the Earth postdate the late veneer but some samples from Isua, Greenland, provide a window on the composition of the planet before this event. W isotopic ratio didn't change with the later geological events. Thus, with the use of the W isotope like a tracer on these samples, it's possible to know the composition of the Earth at its early history. The results traduce that W isotope ratio has an increasing after core formation and maybe after the segregation of an early-enriched reservoir. The high-precision measurements shows a secular change in terrestrial ε182W. Measurements of Isua metasediments yielded negative ε182W which argued for a meteorit impact. However, they have also been shown to have terrestrial Cr isotopic compositions, which are normally highly sensitivities of such Cr measurements to meteoritic additions. The analysis note a low HSE contents of the Isua source, but making inferences from the measured HSE abundances is probably unreliable because of the magmatic and metamorphic history of the rock.

The other hypothesis try to consider other processes that might have resulted in a lowering of ε182W over early Earth history. The second hypothesis is a mixing model which suggests a core-mantle interaction with mantle plumes. Nonetheless, there is no discernible evidence for the current return of core material to the mantle and the late veneer hypothesis make a more compelling explanation of the ε182W.

The last model is based on the hypothesis of a partial remixing of a deep mantle reservoir. But the coupled ε182W and ε142Nd isotope data don't show an evidence for a hidden reservoir. However, these isotopic changes could be linked if the terminal bombardment initiated convective mixing.

The late veneer model offers the most appropriate response to the problematic. It can explain the secular change in ε182W but don't explain the decrease observed in ε142Nd. Actually, as a lithophile element, the budget of Nd will be insignificantly influenced by the late meteorite addition.

Ludivine MATHIEU

Exploration results confirm potential to boost Nayega resource

LEANDI KOLVER | 16th October 2014

This article deals with the exploration results from pit sampling at Aim-listed Ferrex's Nayega manganese project in Togo. These results have confirmed a number of targets with potential to increase the current project. The methods used are mapping and sampling. The current project is an open pit manganese mine. Two news targets are identified. They have the potential to increase the estimated ore-reserves of the current project about 11 million tons, corresponding to 250,000 tons per year.
In addition, the two identified targets are located within easy trucking distance of the planned plant at Nayega.

Christina THOUVENOT

Exploration of deep seabed polymetallic sulphides: Scientific rationale and regulations of the International Seabed Authority

Anju Pandey
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This article provides a comprehensive review of the science behind locating polymetallic sulphide deposits in geological setting of deep seabed as well as about the ISBA Regulations for their exploration.

The deep seabed polymetallic sulphides are found in mid-ocean ridge and the size and location of PMS deposits in these ridges depend upon several features. These features are mainly controlled by spreading rate of the mid ocean ridges (MORs). Indeed, MORs are categorized mainly in three types, i.e., fast-intermediate-and slow-spreading ridges.

Polymetallic sulphides have been consistent source of base metals like iron, copper, zinc and lead. Additionally, some PMS deposits exhibit significant gold (0–20 ppm) and silver (0–1200 ppm) occurrence as well.

As the demand of these metals is showing an astoundingly increasing trend, due to economic growth in China and other developing countries, the search for their resources has also increased in similar folds. This has resulted in many nations focus on deep seabed resources of the polymetallic sulphides. Consequently, International Seabed Authority (ISBA) has prepared the regulations for obtaining licence for exploration of these deposits and several countries have already obtained the licence.

Quentin FAYARD

Kimberlite emplacement temperatures from conodont geothermometry

Jennifer Pell, James K. Russell, Shunxin Zhang

Kimberlites are ultramafic rocks, coming from a deep-sited source, the mantle. They are the main source of diamonds, thus explaining the interest people hold in them. However, their eruptive model is poorly constrained: No kimberlite eruption has been historically observed, making it harder to directly determine the emplacement temperatures. Theoretical values have been calculated in previous papers, based on assumptions regarding the melt and its various characteristics. However, minimal emplacement temperatures have also been inferred from various, reliable methods. Here, the conodont Colour Alteration Indices (CAI) is used within kimberlites pipes from the Chidliak kimberlite field in Canada.

Conodonts were recovered from 76 Paleozoic carbonate xenoliths, within 11 pipes of the deposit. The values range from 1.5 to 8. The cooling model inferred a time-window of 10000 to 20000 h, with a range of heating temperatures of the xenolith from 225°C to higher than 925°C. The main temperatures seems to be around 460°C to 735°C, with a maximum going up to 925°C, which would then be the minimal temperature for the formation of the kimberlite. Lastly, those CAI values display variations inside the pipes, but also between the pipes. This emits the possibility of a multiple events deposition, with a variation in the eruption style, ranging from high energy, explosive style to low energy fire fountain.

To conclude, it seems that the CAI is a reliable and effective geothermometric tool.

John-lee DUBOS

Antimony dispersion at abandoned mines in Sardinia, Italy

This article studies the Sb occurrence in water and potential dispersion in the atmosphere at Su Suergiu (Sardinia, Italy) because concentrations of Sb above drinking water standards may occur in water draining abandoned mines. Surface waters downstream of the mine show high concentrations of Sb (up to 1500 µg/L). The contamination observed extends several km downstream of the mine and affects the Flumendosa River, water from which is used for irrigation and domestic purposes.
Water and vegetation samples were collected in spring 2012. Water samples consist of springs, mine drainage, and water draining slag materials. The physical–chemical parameters and alkalinity were measured on site; water was filtered (0.45 µm) and acidified to 1% HNO3 for metal analysis and total Sb by quadrupole ICP–MS using Rh as internal standard. To evaluate the potential Sb dispersion in the atmosphere, 23 leaf samples (*Pistacia lentiscus*) were collected in PE bags, stored at 4 °C and then analyze in laboratory by ICP-MS.
Speciation results show that Sb(V) is the predominant form, while Sb(III) is a minor constituent in waters at Su Suergiu. Results of this study demonstrate that the major process controlling antimony contamination at Su Suergiu is the Sb release from the abandoned slag materials. Drainage from the slag heap affects the Flumendosa river several km downstream of the mine area. Therefore, remediation actions should be addressed to avoid the contact of water with the slag materials and to reduce erosion of the slag heap.

Kévin COPIGNY