

# *International workshop*

## **Geochemical cycle of Ni, Co and Sc: from mining exploration to ecotoxicity**

### **October 17-19, 2017**

### **Nancy, France**

#### **PROGRAMME**

**Keynote speakers in blue (25+5mn) / Other  
speakers in black (15+5mn)**

**Tuesday, October 17<sup>th</sup>**

**9:00 Introduction**

**Leyval C.** (Director of OSU OTELO): Welcome address

**Cathelineau M.** (Scientific director of RESSOURCES21) Research projects on Nickel and associated elements at Lorraine University and the objectives of the workshop

**9:30**

**General overview of needs in the scientific and industrial fields**

*Chairman Michel Cathelineau*

**9:30-10:00**

**A-1 Bailly F.** (CRNT director, Noumea, New Caledonia) – Keynote: CNRT "Nickel" in New Caledonia: Shared vision and transverse programmes from mining to natural and human environment

**10:00-10:20**

**A-2 Le Gleuher M.** (BRGM, Orléans France) - Nickel Market Developments: a review

**10:20-10:40**

**A3- Bernard Robineau** Mining exploration of supergene Ni ore deposits: a panel of new non-invasive investigations before drilling surveys.

**Coffee break**

**Ore formation: Ni in saprolites**

*Chairman/woman Eric Ramanaidou & Marie-Christine Boiron*

**11:00-11:30**

**A-4 Villanova-de-Benavent C.** (Barcelona Univ.) - keynote: The variety of Ni-bearing phyllosilicate ores in the Ni-laterites from the Dominican Republic: a multiscale approach.

**11:30-11:50**

**A-5 Cathelineau M.**, Quesnel B., Myagkiy A., Teitler Y., Boulvais P., Ulrich M., Munoz M. - A three step model for the formation of Ni enrichment as silicates within the saprolite (New Caledonia)

**11:50-12:10**

**A-6 Génin J.-M. R.**, Orberger B., Maubec N., Duée C., Bourrat X., Blaineau P.-G., da Silva Alves A. - Green rust related Fe<sup>II-III</sup> topotactical minerals in hydromorphic soils (gley of aquifers and maritime marshes) and the search of their homologous Ni minerals

**12:10-12:30**

**A-7 Martin F.**, Aymonier C., Einloft S., and Careme C. - Ni, and Co: important cations for crystal chemistry mechanisms and industrial applications.

**12:30 Lunch offered by RESSOURCES21**

## Ni in laterites

*Chairwoman Maité Le Gleuer*

14:00-14:30

A-8 **Herrington R.** (NHM, London) - keynote:  
Palaeo Ni-Co-Sc laterites of Europe: diversity,  
formation and future potential

14:30-14:50

A-9 **Quesnel B.**, Le Carlier de Veslud C.,  
Boulvais P., Gautier P., Cathelineau M.,  
Drouillet M. - **Ni redistribution in laterites:**  
**effects of geomorphology on lateral**  
**transfer, leading to Ni-enrichment in**  
**saprolite**

14:50-15:10

A-10 **Domènec C.**, Galí S., Villanova-de-Benavent C., Soler J.M., Proenza J.A.. - Modeling the formation of oxide-type Ni-laterite profiles. The example of Punta Gorda, Moa Bay, Cuba

15:10-15:30

A-11 **Myagkiy A.**, Golfer F., Truche L., Cathelineau M. - Subsurface Reactive Transport Modelling of the Lateritic Ni mineralization in New Caledonia: A coupled Thermo-Hydro-Geochemical approach

**Coffee break**

15:50-16:10

A-12 Putzolu F., **Boni M.**, Mondillo N., Pirajno F. - The Wingellina Ni-Co Laterite Project (Western Australia): preliminary data

16:10-16:40

A-13 **Ramanaidou E.** (CSIRO, Perth, Australia), Wells M., Godel B. - keynote: Ni-goethites in nickel laterites

**16:40-18:00 All sessions Posters and beers**

**Wednesday, October 18<sup>th</sup>**

## Co-beneficiation of Ni-Co-Sc Scandium: a hidden resource?

*Chairwoman France Bailly*

9:00-9:30

B-1 **Ambrosi J-P** (CEREGE, France) - keynote:  
Fifteen years with New Caledonian lateritic Ni ore and ... so what ?

9:30-9:50

B-2 **Ulrich M.**, Cathelineau M., Boiron M.-C., Muñoz M., Teitler Y. - LA-ICP-MS analysis of Scandium: calibration, and application to in situ analysis of Sc in silicates and oxides

9:50-10:10

B-3 **Teitler Y.**, Cathelineau M., Ulrich M., Ambrosi J.-P., Muñoz M. - Behaviour of scandium from source rocks to laterites

10:10-10:30

B-4 **Lacroix E.**, Cauzid J., and Teitler Y. - In situ analyses of Sc and other accompanying elements (Ti, V,...) in lateritic Ni ores using portable XRF

10:30-10:50

B-5 **Muñoz M.**, Ulrich M., Levard C., Rose J., Ambrosi J-P., Cathelineau M., Teitler Y., Marcaillou C., Hesse B. - Distribution and speciation of Sc in lateritic profiles of New Caledonia using synchrotron-XRF and Sc K-edge XANES spectroscopy

**Coffee break**

## Social acceptance and mining

*Chairman Yann Gunzburger*

11:10- 11:40

B-6 **Merlin J.** (School of Mines, Nancy, UL, France) – Keynote: Science and society relationships in the New Caledonian nickel policy

11:40-12:00

B-7 **Kowasch M.** - Nickel mining and alternative indigenous development in northern New Caledonia?

12:00-12:20

B-8 **Levacher C.** Extracting, measuring, trammimg, loading the nickel. Importance of technique and skills in identities and relations between small and medium mining extraction companies in New Caledonia

### **12:30 Lunch offered by RESSOURCES21**

## **Ore Processing**

*Chairman/woman Cristina Villanova & Lev Filippov*

13:30-14:00

B-9 **Farrokhpay S.** (UL, France, and UQ, Australia) - keynote: Processing of fine grained lateritic ores: new challenges

14:00-14:20

B-10 **Blancher S.B.**, Wallmach T., Graham S. - Mineral quantification in nickel laterite by Mineralogic: breakthrough in statistical EDS analyses

14:20-14:40

B-11 **Saikkonen P.**, Rastas J. - New ways for the Integrated Laterite Processing - An Atmospheric Process for Laterites: H<sub>2</sub>SO<sub>4</sub> – SO<sub>2</sub> –method

14:40-15:00

B-12 Farrokhpay S., Filippov L. - A holistic approach to pre-concentrate nickel in laterite ores

15:00-15:30

B-13 **Hawker W.** (Faculty of Engineering UQ, Australia) - keynote: The extractive metallurgy of agromined nickel

15:30-15:50

B-14 **Simonnot M.O.**, Laubie B., Hazotte C., Jally B., Guipain M., Morel J.L. - Ni agromining:

from hyperaccumulating plants to end-products, a new raw material to understand

15:50-16:10

B-15 **Chagnes A., Omelchuk K.** - Modelling of liquid-liquid extraction of cobalt, nickel and manganese from acidic chloride media.

## **Coffee break and Posters**

## **Phytomining-Agromining**

*Chairman/woman Marie-Odile Simonnot & Will Hawker*

16:30-16:50

B-16 **van der Ent A.** (SMI, UQ, Australia), Echevarria G., Erskine P.D. – keynote: Discovery of tropical hyperaccumulators in New Caledonia and Malaysia, and advancing the development of practical tropical agromining

16:50-17:10

B-18 McCartha G.L., Taylor C. M., and **Pollard A.J.** - Phylogenetic and geographic distribution of Nickel hyperaccumulation in neotropical Psychotria (Rubiaceae)

17:10-17:30

B-19 **Saad R.**, Kobaissi A., Goux X., Echeverria G., Kidd P., Benizri E. - Developing Ni-agromining by associating Alyssum murale with a leguminous plant: an in-situ experiment on an ultramafic site in Spain

## **Thursday, October 19<sup>th</sup>**

## **Phytomining-Agromining**

*Chairmen Antony van der Ent & Guillaume Echevarria*

8:30-8:50

C1 **Roccotiello, E.**, Cecchi, G., Marescotti, P., Di Piazza, S., Rosatto, S., Mariotti, M., Zotti M. - Metals accumulation by fungi and plants in a Mediterranean sulphide mine

8:50-9:10  
C2 **Marescotti P.**, Crispini, L., Fornasaro, S., Mariotti, M., Marsili, S., Roccotiello, E., Zotti M. - Plants and fungi in Ni-, and Cr-rich serpentine soil from Voltri Massif (Liguria, Italy)

9:10-9:30  
C3 **Rozpadek P.**, Domka A., Ważny R., Nosek M., Jędrzejczyk R., Turnau K. - How do the endophytic fungi improve plant adaptation to metal enriched environments?

## Ni geochemical cycle

*Chairmen Christophe Cloquet & Jean-Paul Ambrosi*

9:30-10:00  
C-1 **Quantin C.** (Paris-Sud University, France), Ratié G., Calmels D., Monvoisin G., Vantelon D., Garnier J., Cloquet C., Montargès-Pelletier E., Sivry Y., Ettler V. - keynote: Ni Isotopic fractionation in the surficial cycle of nickel

## Coffee break

10:00-10:20  
B-17 van der Ent A., Cardace D., Tibbett M. and **Echevarria G.** - Pedogenesis of ultramafic soils and biogeochemistry of nickel: ecological implications in Kinabalu Park (Malaysia)

10:20-10:40  
C-2 **Zelano, I.** Cloquet C., Echevarria, G., van der Ent, A., Fraysse F., Montargès-Pelletier, E.- Ni Isotopic Fractionation and Ni recycling in the upper soil layers.

10:40-11:00  
C-3 Grangeon S. - In situ determination of the kinetics and mechanisms of Ni uptake by nanocrystalline Mn oxide: a combined synchrotron and atomic-resolution STEM study

## Ecotoxicology and environment

*Chairman/woman Corinne Leyval & P. Marescotti*

11:00-11:20  
C-4- **Schlekat C. E.** (NiPERA, Durham, USA), Merrington G., Garman, E. - keynote: Positive synergism: How the intersection of environmental regulation and corporate responsibility increased our understanding of nickel ecotoxicology

11:20-11:40  
C-5 **Lopez S.**, Goux X., Van der Ent A., Erskine P. E., Echevarria G., Calusinska M., Morel J.L., Benizri E. - The bacterial community diversity in the rhizosphere of ultramafic soils of nickel-hyperaccumulator species from Halmahera Island (Indonesia)

11:40-12:00  
C-6 **Minguez L.**, Gross, E.M., Vignati, D.A.L., Pain-Devin, S., Devin,S., Guérard, F., Giambérini L. - An integrated approach to the ecotoxicity assessment of nickel and other metals in aquatic organisms: A case study at Lake Ohrid (Albania)

12:00-12:20  
C-7 **Baudrimont M.**, Dominique Y., Gunkel-Grillon P., Juillot F., Boula A., Laporte-Magoni C., Semaoui Folcher N., Bellec J., Maury-Brachet R., Gonzalez P., Gourves P-Y. and Feurtet-Mazel A. - Mining activities in New Caledonia: transfer of Ni, Cr, Co, Mn and Fe in freshwater trophic webs from natural biofilm to carnivorous fish

*Lunch offered by RESSOURCES21*

## Remediation programmes

*Chairman/woman Sophie Leguédois*

13:30-14:00  
C-8 **Colin F.** (DRCE IRD-CEREGE and Vice-Chair of the IRD scientific council) - keynote: Towards a more sustainable mining activity based on circular economy principles: rational and perspective in New Caledonia?

14:00-14:30

C-9 **Quintela-Sabarís C.**, Masfaraud J.F., Séré G., Echevarria G., Leguédois S. - Efficiency of reclamation and processes on soils from ultramafic areas degraded by human activities: a mesocosm study

14:30-14:50

C-10 Lagrange A., Rigault F., L'Huillier L., Derroire G., Jaffré T., **Ambrosi J.P** - Phytosociology and soil chemistry relationships on an ultramafic weathering sequence in the South West of New Caledonia

14:50-15:10

C-11 **Cerdeira-Pérez A.**, Monterroso C., Barreira Díaz M., Machinet G., Echevarria G., Prieto-Fernández A., Kidd P. - Assessment of Ni phytomining feasibility in a mine spoil dump and plant growth optimization using waste materials as soil amendments

15:10-15:30

C-12 Auber E., Masfaraud J.F., Faucon M.P., Saad R., Sumail S., Van der Ent A., Repin R., Sugau J., Nilus R., Echevarria G., Leguedois S., **Quintela-Sabarís C.** - Pioneer Casuarinaceae from Bornean serpentines: potential tools for soil restoration

15:30 - 16:00. Closure discussion

End of the meeting

## POSTERS

### Ore deposits

PA1 Duée C., Da Silva Alves A., Maubec N., Blaineau P-G., Orberger B., Bui T., Pillière H., Bourrat X., Le Guen M. - Highlighting of nickel using the hyperspectral signal of minerals originating from New Caledonia lateritic profiles

PA2 Maubec N., Blaineau P.G., Duée C., Da Silva Alves A., Orberger B., Bourrat X., G. Wille, M. Le Guen - Mineralogical and cristallochemical characterizations of Ni-bearing clays

PA3 - Tourneur E. and Chauvet A. The Co-Ni Arsenides ore of Bou Azzer, Morocco: respective role of Hydrothermal and Structural control on their mode of formation? Preliminary results from combined structural, microtectonics, textural and mineralogical studies

### Phytomining-agromining

PB1 - Saad R., Kobaissi A., Amiaud B., Ruelle J. , Benizri E. - Changes in soil physicochemical characteristics and root architecture of Alyssum murale cropped with a legume on a serpentine soil

PB2 - Navarrete Gutiérrez D. M., Echevarria G., Pons M.-N., Cuevas Sàncchez J. A. - Ultramafic (serpentine) habitats in Mexico

PB3 - Quintela-Sabarís C., González-Prieto S., Saad R., Benizri E., Philippot L., Kidd P. - Improving Ni-agromining with Mediterranean hyperaccumulators: the role of fertilisation and co-cropping with legumes

PB4 - Pollard A.J. - Biogeochemical Cycling of Nickel in Ultramafic Forests: A Comparison of Tropical Rainforest, Tropical Dry Forest, and Temperate Deciduous Forest

PB5 - Ridard C., Rosenkranz T., Kidd P., Echevarria G., Puschenreiter M. - Evaluating Ni phytomining efficiency on Austrian serpentine soils in a long-term field experiment

PB6 - Saad R., Kobaissi A., Machinet G., Villemain G., Echevarria G., Benizri E. -

Improving the structure and the biofunctioning of an ultramafic soil with agro-ecological agromining

PB7 - Navarrete Gutiérrez D. M., Echevarria G., Pons M.-N., Cuevas Sàncchez J. A - Thinking agromining in terms of optimisation of ecosystem services

PB8 - Tognacchini A., Puschenreiter M., van der Ent A., Machinet G., Echevarria G., Kissel J. - Nickel phytomining from waste-derived technosoils: substrate formulation and phytotoxicity assessment