New Caledonia, a specific full size research laboratory to investigate lateritic Mining resources exploitation development, governance, impacts over the last century and to promote a new model for responsible mining

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Abstract

New Caledonia owns about 25% of the world’s nickel resources, and around 9% of the world’s reserves, distributed over 300,000 hectares of concessions allocated to date (18% of the total surface of the main island). Supergene weathering of ultramafic rocks have led to the genesis of lateritic nickel-rich ores of garnierite type (NiO > 1.5%) and/or iron oxi-hydroxide type (NiO < 1.5%) under tropical lateritic conditions that have prevailed over 30 millions of years. These conditions have shaped the landscapes while offering Ni-rich regolith easy to exploit by open pit mining. Since 1880, nickel has been so far used as an economic driver and a societal development impetus. Since 1998, three worldwide projects have been developed, using pyrometallurgy (Ni-Si) and more recently hydrometallurgy (Ni-Fe) ore processes. However, natural erosion, anthropogenic disturbances (climate change, fires, urbanization, mining) can add up to disrupt the whole terrestrial and marine ecosystem functioning at the regional scale. This critical mined zone is covered by terrestrial ecosystems of great endemic biodiversity and adjoining a lagoon that has been listed as a UNESCO World Heritage Site in 2008. Such ecosystems are a valuable natural resource for the sustainable future for the next generations. Are mining and preserving ecosystems compatible, and for what economic and societal model? The conference reviews a collective research approach (mining, terrestrial and marine ecosystems impacts, restoration, biorecycling) to address this question. The corpus of acquired knowledge allows to propose an inclusive model of responsible mining activity, based on the “co-valorization” of both non-renewable and renewable primary resources through the development of circular economy and bio-economy principles, and applied all along the “mining ecosystem” project management. Considering i) the present day low GDP input of nickel mining in New Caledonia, the 98% dependency rate from fossil sources of energy, the CO2 emissions and the volatile Ni-market international context, this model, if followed, will reinforce the societal cohesion and develop a sustainable economy diversification, while enhancing energy transition and a better ecological efficiency.
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Global context: Conjugating mining production and biodiversity preservation: a world development issue

The critical mining zone an holistic full-size area investigated from the year 2002 by multidisciplinary research teams through public and private trust partnerships (IRD, CEREGE, IRD New Caledonia, IRD Nouméa, BPA5, 98800, Noumea, New Caledonia, IRD Nouméa, BPA5, 98800, Noumea, New Caledonia and many other organizations). The tremendous increase of knowledge and skills acquisition has developed, inducing dedicated and appropriate decision support system towards public and private operators. This has contributed to improve the best practices of mining activities all along the life cycle of the mining process included CSR developments, allowing a reduction of negative impacts, a better sharing of mine revenues, and a better social acceptability.

Since the year 1990, poorly surficial Ni-Fe ores are increasingly exploited (hydrometallurgy) and because these minerals are very extensive on the surface, its may induce very significant damages to ecosystems and disrupt the environmental balance of ecosystems. In addition, from 2008 (world economic crisis) to present time, even if the GDP/Inhabit remains constant, for the first time in its history, New Caledonia’s real growth rate is inversely correlated to its nickel increasing production, to reach a very low rate of 2%. The Ni weight of nickel income in the total NC GDP reaches its lowest value of 4.5%. In addition, the production of CO2 increase from 2008 at a annual rate of 4.5% due to the use of coal-fired power plants to produce the energy required for metallurgical power plants (8 MTOe/y emitted = 30t of CO2 eq./hab.)

In a consequence, based on the knowledge intangible capital issued from research, we promote a new virtuous spiral model of mining activity, that will simultaneously permits to develop a sustainable diversified economic success from rare natural resources and to value the skills acquired (www.amdec-network.science).