

**Cobalt and its salts can be used in the following applications (list is not exhaustive):**

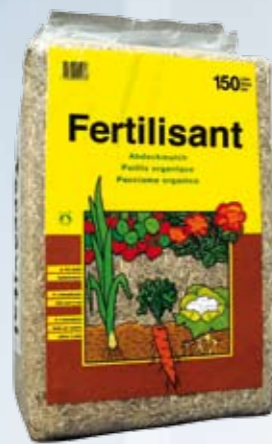
- Cements and cement industry.
- Blue pigments: pencils, enamels, inks, eye shadow, paints, plastics, porcelain, tattoos, dyes, textiles, glass...
- Paint manufacturing (fluorescent paints) and with pigments.



- Paint and varnish driers.
- Ceramic industry, pottery, glass where cobalt is used as pigment.
- Dyes and catalyst in the rubber and plastic industries (in particular resins, polyesters), pharmaceutical and textile industries.
- Various alloys: resistant metals (in particular vitallium for metallic prosthesis).
- Semiconductor manufacturing.
- Galvanization industry.
- Printing (offset) and photography.
- Catalyst for hydration of mineral oils.
- Cooling agent and oil lubrication.
- Used cutting oils.



- Detergents and washing powders.
- Food additives (essentially for cattle).
- Hair dyes.
- Deodorants.
- Dental prosthesis.
- Plastic for glasses' frames.
- Fluid for barometer and hygrometer.
- Fertilizers.
- Stabilising agent used in beer manufacturing.
- Products and protection for wood.



**Cobalt can be found in certain foods:**

Averages provided\* for 100 g net Products (mg)

Dried apricots	0.020
Onions	0.013
Pears	0.010
Broccoli	0.010
Tomatoes	0.009
Spinaches	0.002

**IN BRIEF**

Nickel is a metal extremely widespread in every day life. It is part of the composition of numerous alloys including stainless steel.

Each year 1,350,000 tons of metallic nickel are produced in the world to which can be added another 45% produced from recycled metal.

Nickel is extracted from mines in New Caledonia, Australia, Russia, Canada, Indonesia and the Philippines.

Up until now cobalt was not mined in New Caledonia, it is the hydrometallurgical process which will allow to profitably exploit it.



**And at Goro Nickel?**

The Goro Nickel plant will produce approximately 4,500 tons of cobalt annually, i.e. 10% of the current world's offer in the form of cobaltous carbonate containing 45% of pure cobalt. This cobaltous carbonate will be used in pigments for paints but mostly for the manufacturing of Li-ion batteries (lithium-ion batteries) for photography, video or mobile phones.

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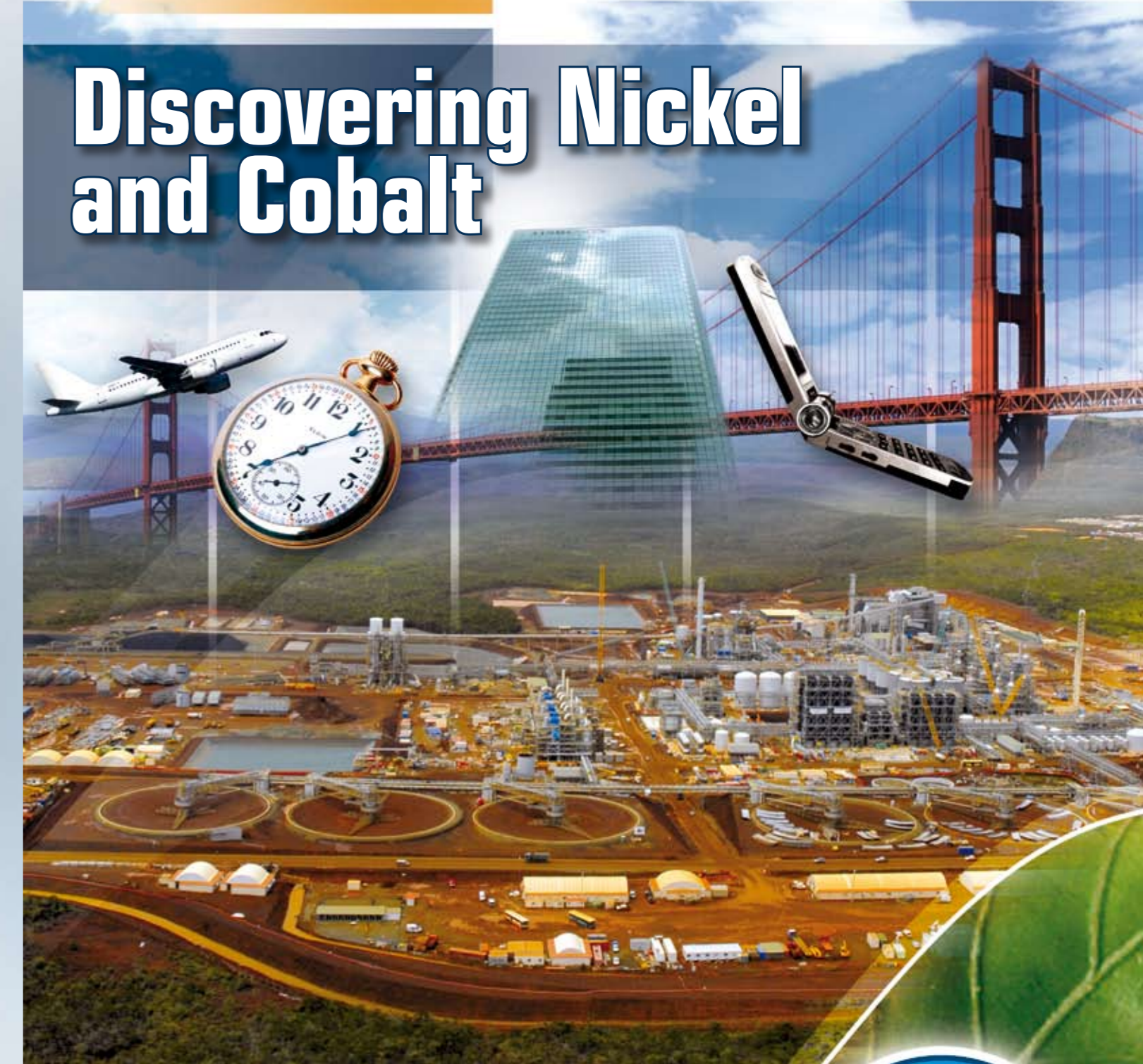
*With you,*

JANUARY 2008

**INFOS**

GORO NICKEL NEWSLETTER N°6

**Discovering Nickel and Cobalt**



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- What does it look like?
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A small number of elements exist on the planet with varied properties and resource abundance which have enabled the development of multiple industrial or domestic applications. This is how nickel, the fifth most common element in the earth's composition is one of the key metals in the manufacturing of current electrical car batteries. Each year 1,350,000 tons of metallic nickel are produced in the world to which can be added another 45% produced from recycled metal. Nickel is extracted from mines in New Caledonia, Australia, Russia, Canada, Indonesia and the Philippines.

Nickel price has increased highly since early 2006. It should be noted that half of the world's production is done by five multinational companies. Nickel demand is essentially driven by that of stainless steel which uses two thirds of the nickel produced.

## 1 • NICKEL

Nickel is a chemical element; with the symbol Ni and atomic number 28.

Nickel is a metal not very well known by the general public as it is generally mixed with other products in alloy forms. It has a rich combination of properties which makes it an indispensable element in every day life.

### What does it look like?

Nickel is a white silvery metal with a polish luster; it is hard but malleable, withstanding well to corrosion and high temperatures. Goro Nickel extraction process allows producing nickel in the form of spherical granules constituted of successive layers.



Nickel Oxide

Numerous civil engineering works contain nickel to withstand corrosion



### What is it used for?

Nickel uses are just as numerous as that of stainless steel: from food packaging to building, and from the chemical industry to kitchen equipment.



Nickel can be used in the following applications (list is not exhaustive):

- Aircraft and rocket engines.
- Outdoors civil engineering works. Construction.
- Stainless steels.



- Clothing accessories: clasps, buckles, jeans' buttons, zips, bra hooks, metallic gloves, suspenders, glasses' frame, shoe eyelets, hair pins, snap fasteners, reinforcement for safety shoes.
- Jewelry: needles used for ear piercing or other piercings, earrings, bracelets, watches, brooches, neck chains, necklaces, pendants...



- Various metallic objects: needles, metallic edges of certain desks, lighters, ashtrays, chains, scissors, keys, thimbles, tips and accessories for musical instruments, pins, toys, office material, various tools, coins.
- Medical accessories: needles, acupuncture needles, surgical instruments, orthosis, pacemakers, metallic part for hospital beds, dental prosthesis in "white gold", orthopaedic prosthesis...
- Galvanization industry.
- Dyes, stains for paper and paint.
- Stain and coloring agents for ceramics, ceramic and glass.



- Colorant for oils.
- Enamel paint: yellow (nickel phosphate), green (nickel oxide).
- Printing and dye for certain textiles.
- Catalyst and reactant for the plastic industry.
- Various alloys: duralumin, platinum, vitallium...
- Copper and zinc blackening.
- Grease hardening.
- Alkaline batteries.
- Absorbent in certain gas masks.
- Détergents: in low concentration.
- Used cutting oils.
- Used tin-based brown pigments for eye shadow.
- Certain cements.

### Did you know?

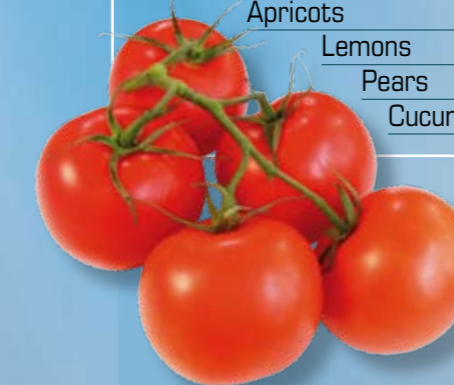
That France requested that the euros coins contained nickel to maintain employment in the mining extraction sector.



### Nickel can also be found in foods:

Averages provided\* for 100 g net Products (mg)

Pecan nuts	1.500
Cashew nuts	0.500
Peas	0.220
Parsley	0.070
Cherries	0.050
Broccoli	0.050
Potatoes	0.030
Spinaches	0.023
Tomatoes	0.023
Apricots	0.020
Lemons	0.020
Pears	0.020
Cucumbers	0.020



### And at Goro Nickel?

The finished product coming out of the Goro Nickel Plant is nickel oxide; its chemical formula is NiO.

The 60,000 tons of nickel in the form of nickel oxide to be produced by hydrometallurgical process at the Goro Nickel plant will contain 76-78% nickel the remainder being oxygen.

## 2 • COBALT

Cobalt is a chemical element with the symbol Co and atomic number 27; its atomic mass is 59.

Cobalt like its salts is very wide spread in our environment. Thanks to its metallurgical process Goro Nickel will produce cobalt at the same time as nickel contained in the Goro Plateau. Cobaltous carbonate is obtained at the end of the process; its chemical formula is CoCO<sub>3</sub>.

### What does it look like?

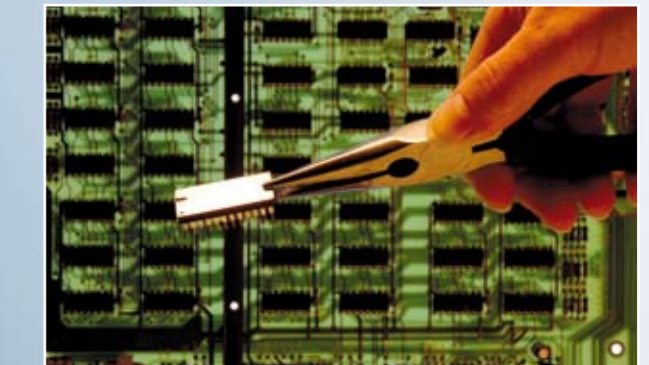
Cobalt is present in nature where it represents approximately 0.002% of the earth's crust. It is often associated with nickel and copper.



Cobaltous carbonate

### What is it used for?

One of the properties of cobalt is to provide alloys with a heat and corrosion resistance. Therefore it is in the composition of numerous alloys used in electrical, aeronautical and automobile industries (together with chromium, nickel, molybdenum, beryllium, aluminum or copper), or very hard alloys for high speed cutting (together with chromium, molybdenum or tungsten). The insertion of cobalt in the composition of these alloys represents 45% of the world's cobalt consumption.



It is used in the manufacturing of permanent magnet, refractory metals, pigments for glass and ceramics, driers and pigments for the paint & varnish industries, agricultural fertilizers and additives for animal foods. The electronic industry has highly increased its cobalt demand and it is the domain with the highest growth. Battery manufacturing alone represents 11% of the consumption.

