

# NICKEL DEPOSITS IN VENEZUELA

## BIBIOGRAPHIC REFERENCES OF NICKEL DEPOSITS IN VENEZUELA THROUGH THE STRATIGRAPHIC CODE OF VENEZUELA, GEOREF, ASTER VNIR IMAGES, GOOGLE EARTH AND INTERNET

Mariato Castro Mora, 2022



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### Background in Venezuela

In January 1961, the Ministry of Mines and Hydrocarbons, through the Directorate of Mines and Geology, carried out a systematic investigation of the Loma de Hierro nickel deposit in order to establish its economic importance. The development of this program allowed evaluating until December 31, 1962 reserves that reached 45,899,943 metric tons of ore with an average grade of 68.1%.

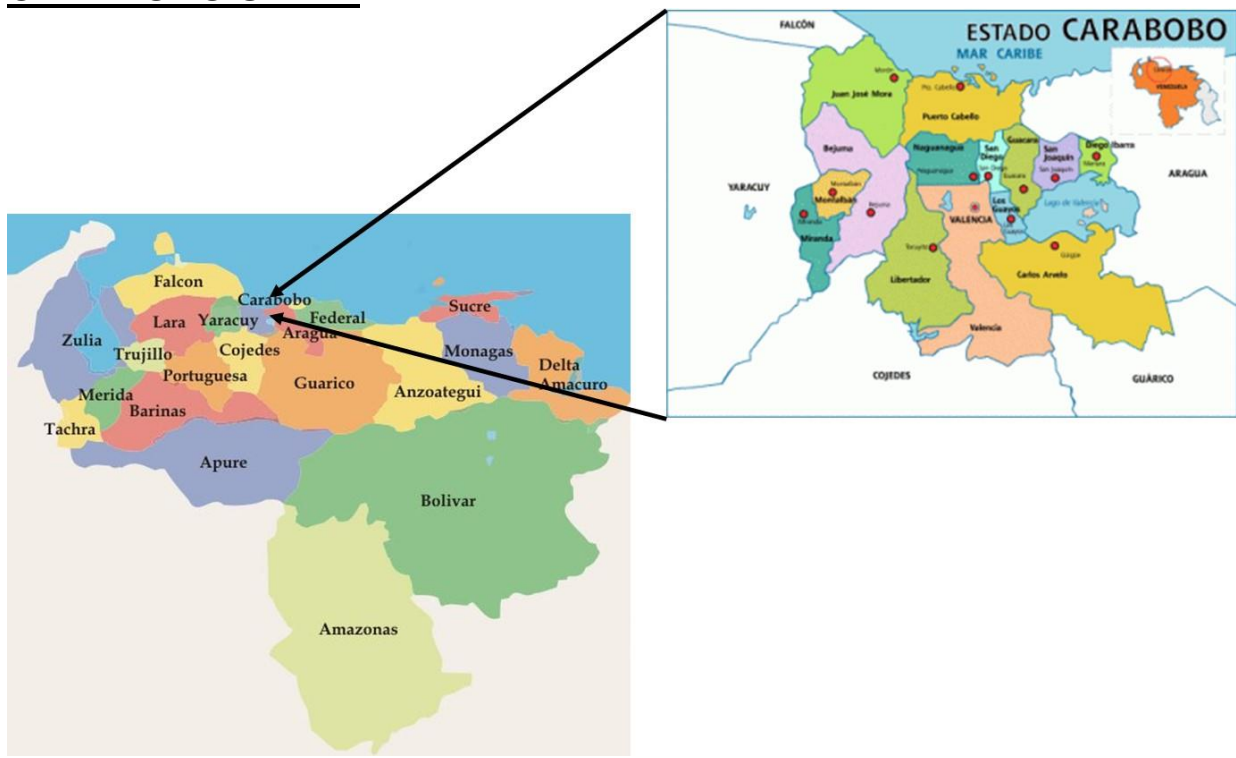
In Venezuela nickel deposits are associated with serpentized ultrabasic rocks of the Cordillera de la Costa. All the deposits and manifestations studied are of the lateritic type.

Following is a summary of nickel locations in Venezuela mentioned in the geological and mining bibliography:



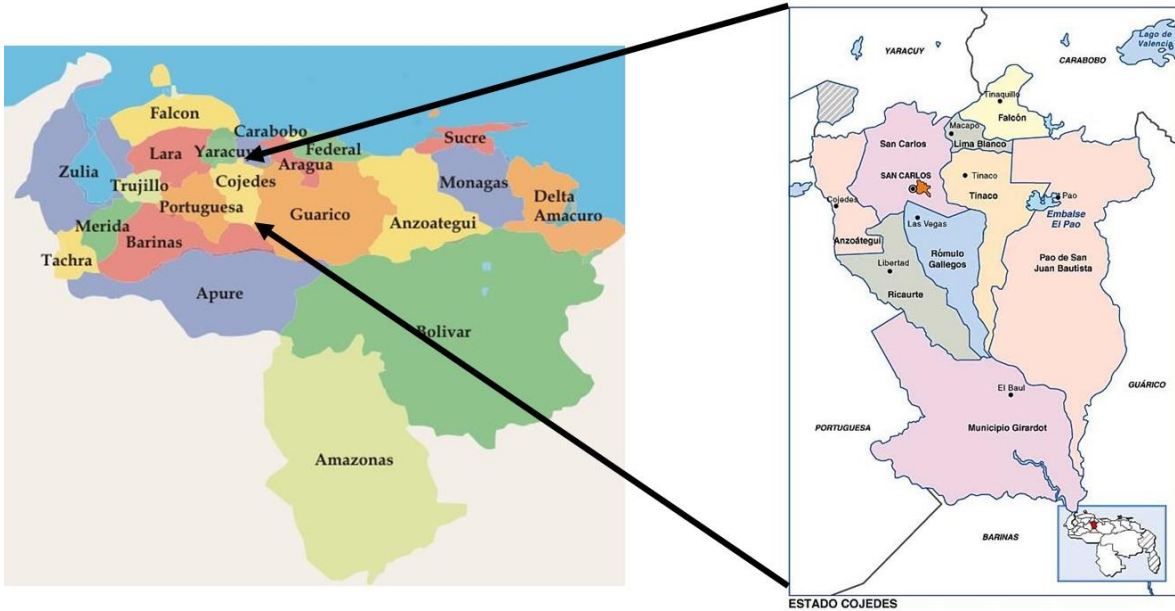
State	District	Location	Location Relative	Coordinates	Age	Complex	Super Group	Group	Formation	Area	Rock Type	Official Map
Bolívar					Precambrian	Supamo						7737
		Piston de Uroy??									Mafic and ultramafic complexes	
		Real Corona-El Torno??									Mafic and ultramafic complexes	
	Roscio	Serranía Verdun- Cerro Piedra del Supamo	250 km south-southeast of Puerto Ordaz City, 60 km south of Tumeremo Town. Access by helicopter or a 5 hour boat trip from El Dorado	6° 38' 00" - 6° 50' 00" N / 62° 00' 00" - 61° 47' 00" W	Early Proterozoic		Pastora	Botanamo / Carichapo	Callao / Cicapra/Yuruarí / Caballaje / Los Caribes	344 km2		7637 / 7739 / 7638 / 7738
	Cerro La Esperanza											

### CARABOBO STATE



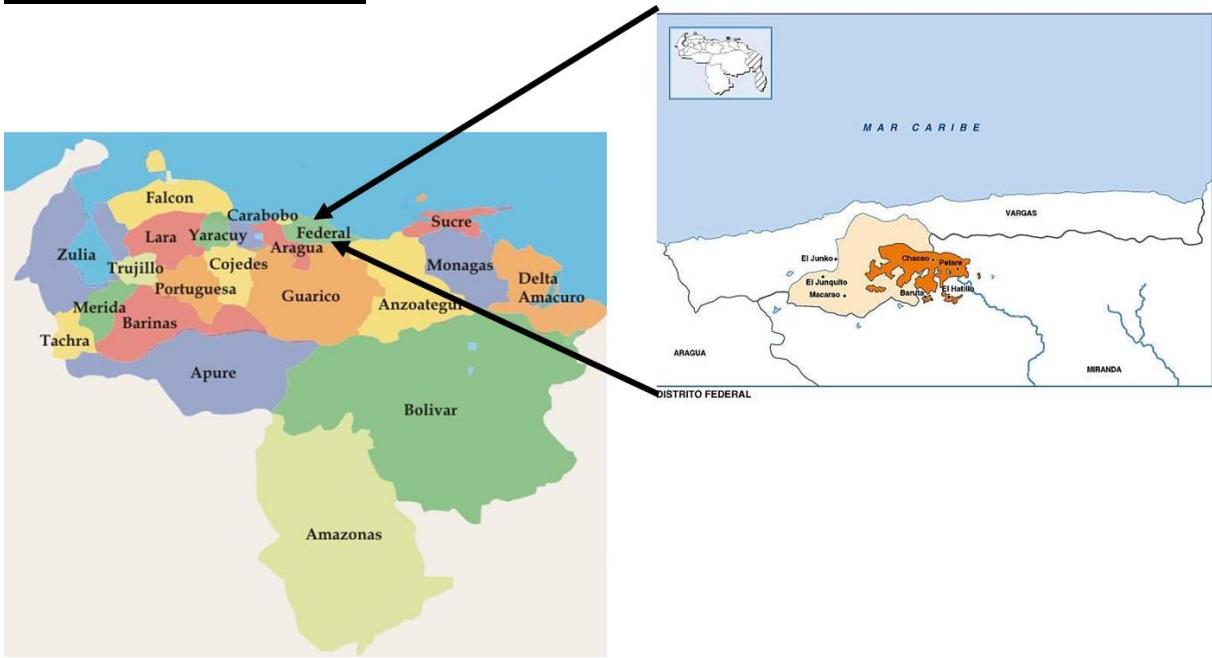
State	Location Relative
Carabobo	Near to Valencia City

## COJEDES STATE



State	Community	Location	Location Relative	Coordinates	Age	Complex	Rock Type	Official Map
Cojedes	Falcón	Tinaquillo (Tinaquillo Nickel Mine)	Near to Tinaquillo Town	9° 53' 00" N 68° 24' 00" W	Late Paleozoic-Early Triassic (host rock) / Cretaceous / Quaternary-Holocene (mineralization)	Tinaquillo Peridotite	Serpentine	6545

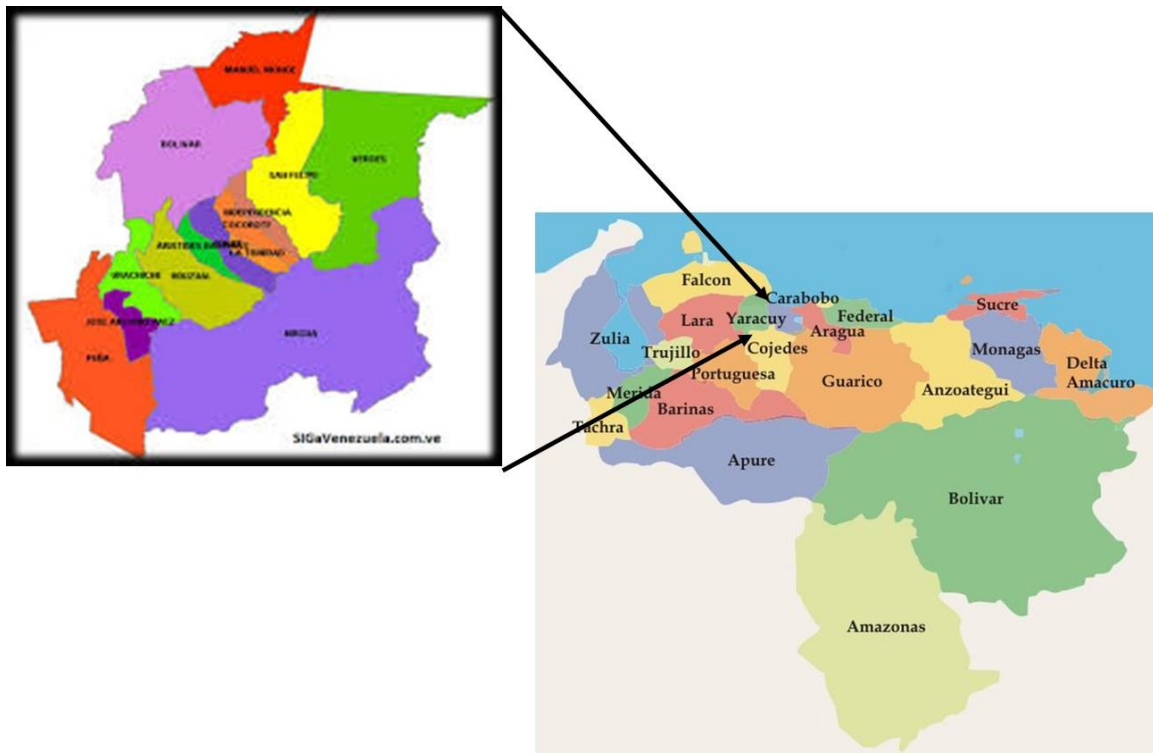
## DISTRITO FEDERAL







## YARACUY STATE

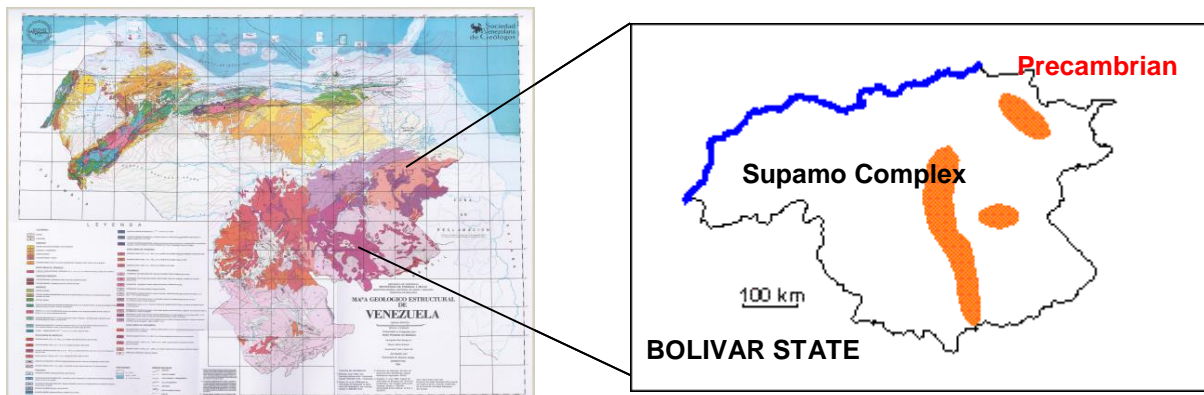


State	District	Location	Coordinates
Yaracuy	Autónimo Sucre	Santa María	10 ° 14' 38" N 68 ° 42' 03" W
		Cabimba	

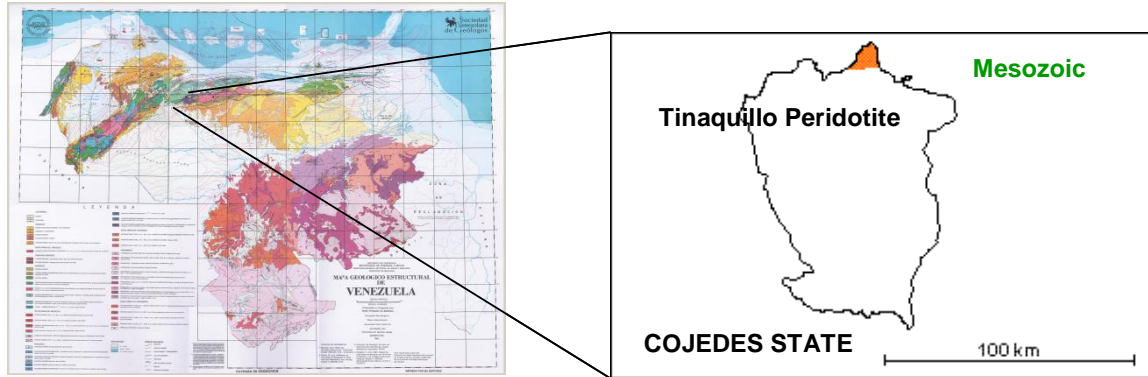
## STRATIGRAPHIC UNITS

### SUPAMO COMPLEX

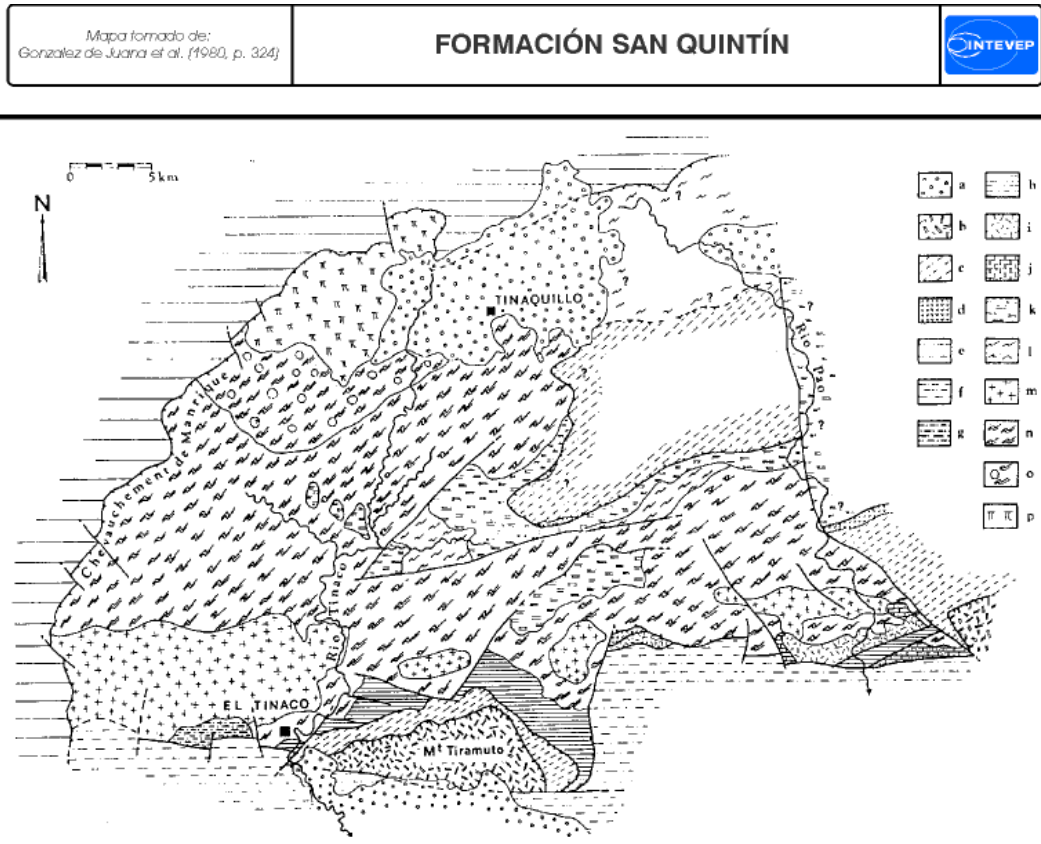
Precambrian



## Tinaquillo Peridotite Mesozoic



Geological map of Tinaco – Tinaquillo massif. Compilation from the maps of MacKenzie 1960, Menéndez 1965, Oxburgh 1965 and Jarvis 1965



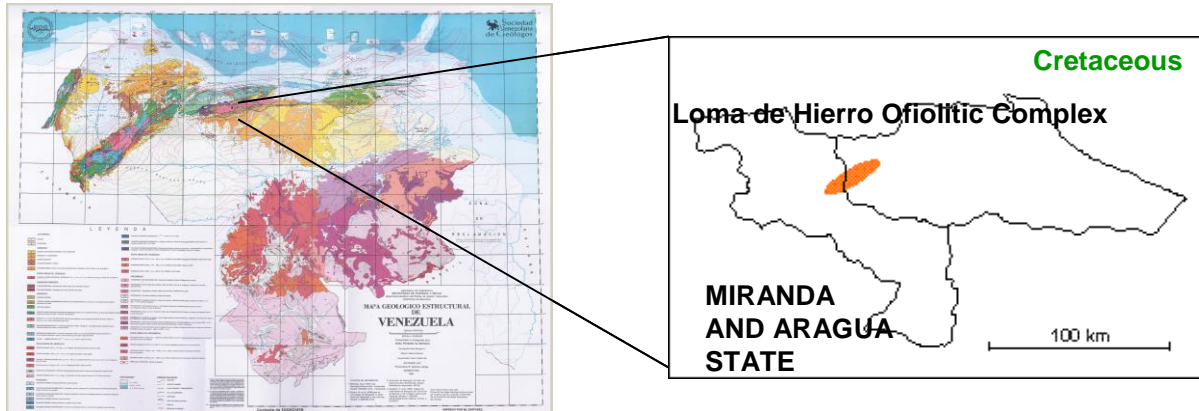
Esquema geológico del Macizo de Tinaco-Tinaquillo; según los mapas detallados de MacKENZIE (1960), MENENDEZ (1965), OXBURGH (1965) et JARVIS (1965).

**Leyenda:** a. Cuaternario; b. Napa de Villa de Cura; c. Napa de Loma Hierro; d. serpentinitas; e. Zona de la Cordillera de la Costa; f. Zona Piemontina; g hasta p. Macizo de Tinaco-Tinaquillo; g. Eoceno superior; i. rocas volcánicas básicas cretáceas (Fm. Pilacones); j. Cretáceo inferior; k. sedimentos y lavas metamorfozados (Cretáceo inferior ?); l. micaesquistos y metaconglomerados (de Tinapú); m. tronjemitas; n. gneis y anfíbolitas (Complejo d' El Tinaco); o. halo de metamorfismo de contacto; p. peridotita (de Tinaquillo).



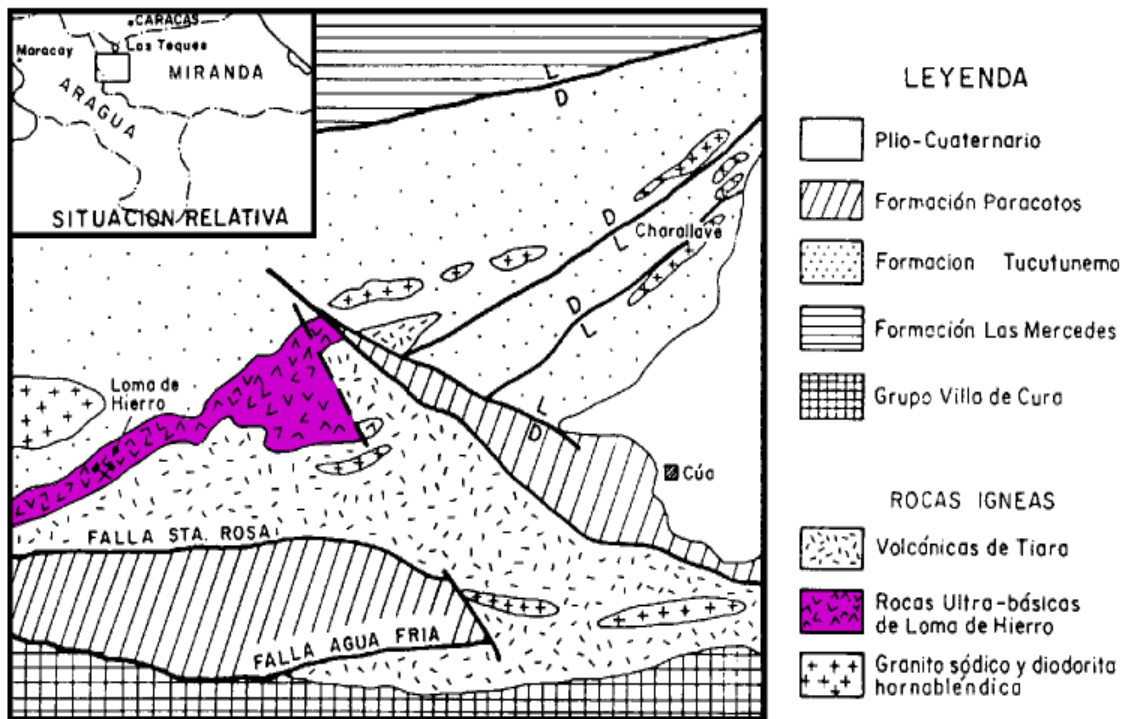
## VILLA DE CURA OFIOLITIC COMPLEX

### Cretaceous



Mapa tomado de:  
González de Juana et al. (1980, p. 355)

**COMPLEJO OFIOLÍTICO DE LOMA DE HIERRO**

Mapa geológico simplificado de la parte occidental del Estado Miranda, indicando el área de afloramientos de las ultramáficas de Loma de Hierro. Simplificado de Bellizzia (1967).

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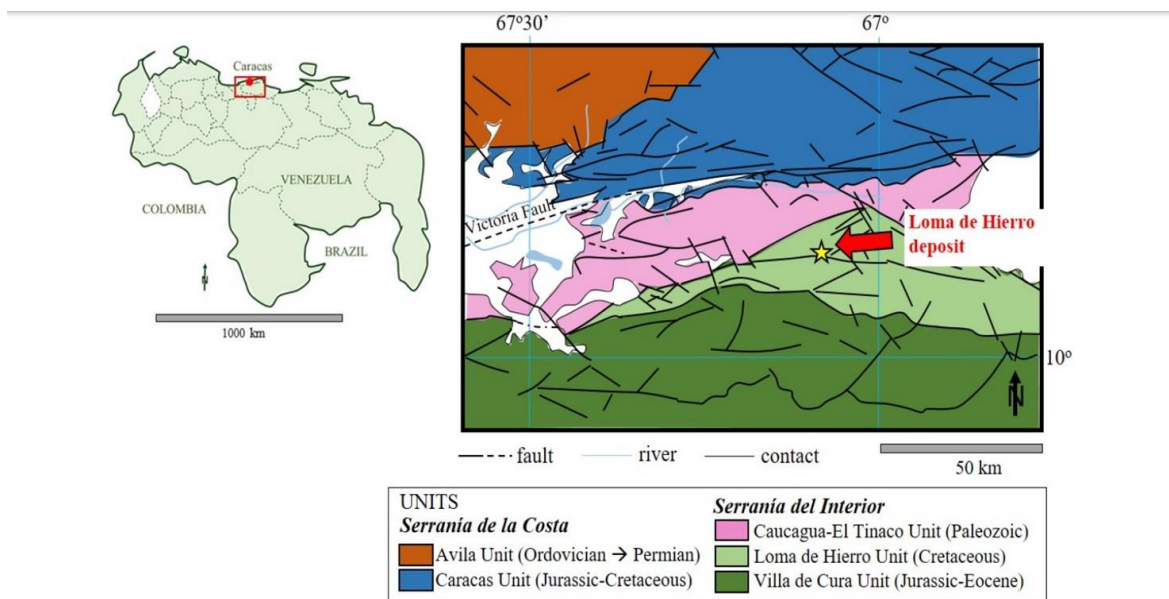
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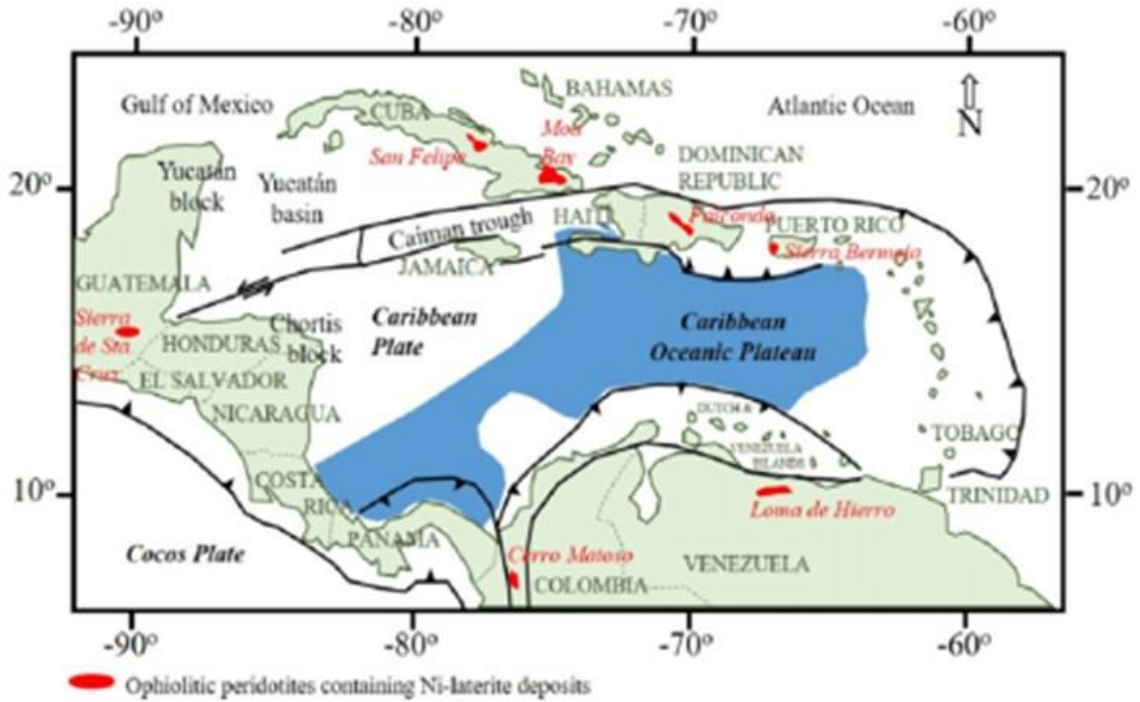
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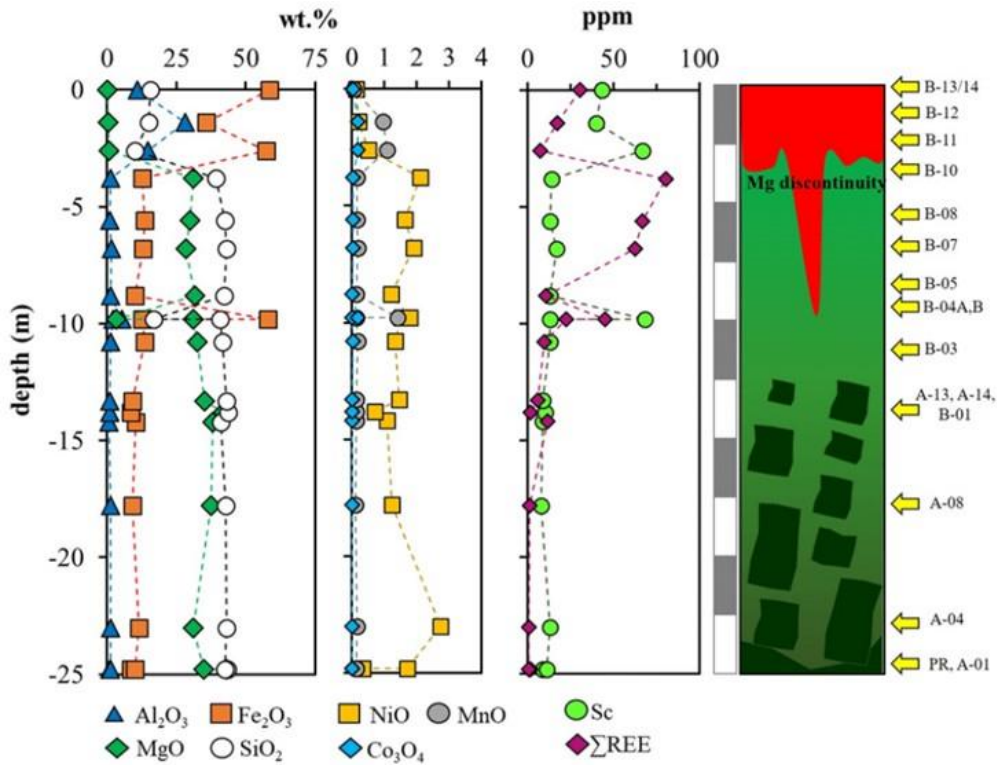
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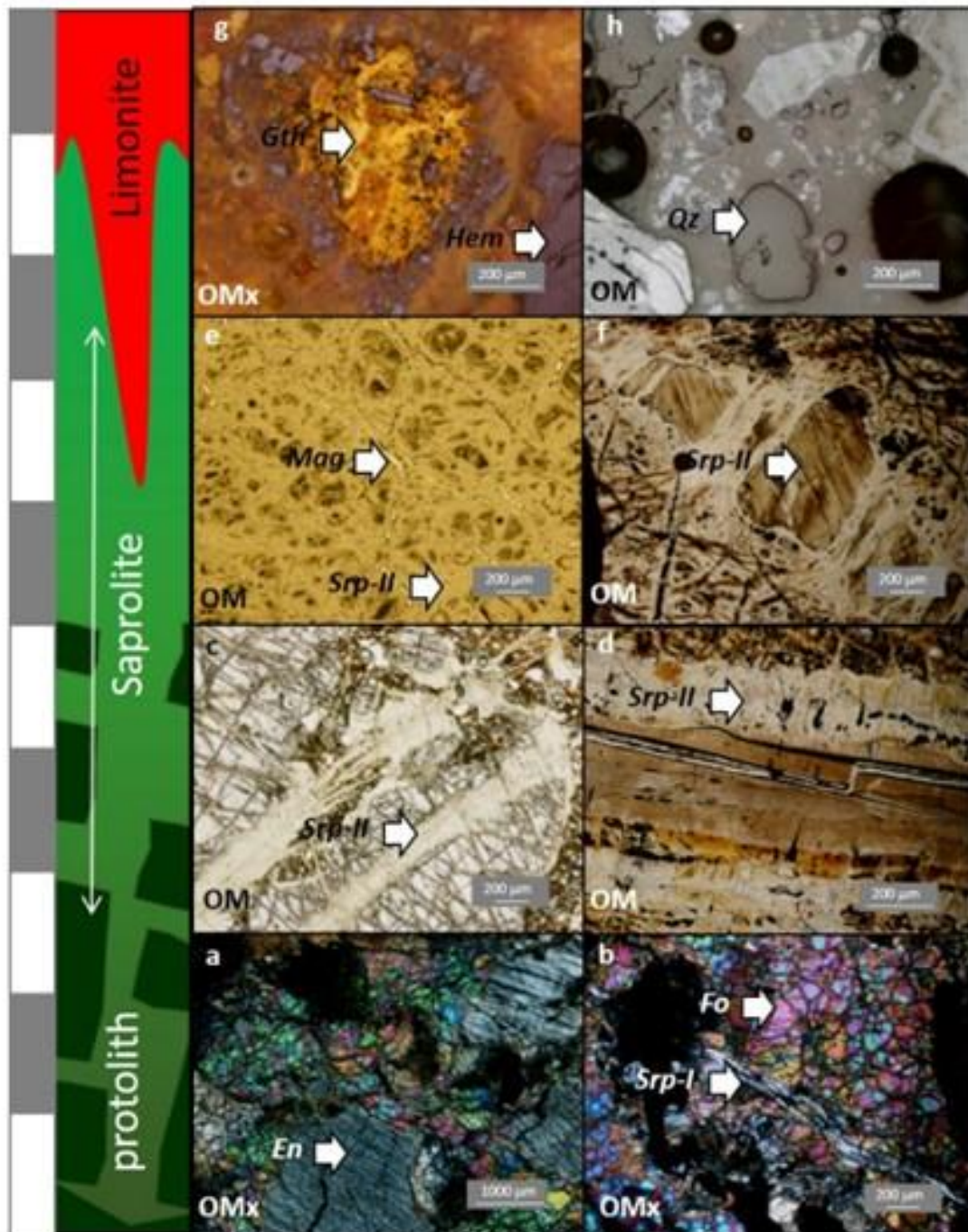
**Figure 2** Simplified geological map of the study area showing the location of the Loma de Hierro laterite deposit. Simplified from Hackley *et al.* (2006).



Distribution of ophiolitic peridotites containing Ni-laterite deposits around the margins of the Caribbean Plate. Ni-laterite deposits from Moa Bay and San Felipe (Cuba), Falcondo (Dominican Republic), Sierra Bermeja (Puerto Rico), Loma de Hierro (Venezuela),



Idealized Ni-laterite profile (right) from the Loma de Hierro laterite deposit (Venezuela) showing the location of the samples, with contents of major and relevant minor elements (in wt.% oxide), Sc and REE (in ppm).



**Figure 8.** Plane polarized light (OM) and crossed polars (OMx) optical micrographs of (a-b) the protolith, (c-f) the saprolite horizon and (g-h) the limonite horizon. (a-b) Transmitted light optical images of sample A-14, showing well defined grains of enstatite (En) and fractured forsterite (Fo) crossed by primary serpentine (Srp-I). (c-d) Transmitted light optical images of sample A-1, showing the formation of Srp-II in fractures crossing protolith forming minerals. (e-f) Transmitted light optical images of sample B-10, showing previous forsterite and enstatite grains replaced by serpentine and surrounded by magnetite. (g-h) Reflected light optical images of sample B-13/14, showing grains of goethite, hematite, and quartz.

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**Stratigraphic Code of Venezuela** 1997. PDVSA Intevep

*"The ultrabasic rocks in northern Venezuela form two defined belts along the Cordillera de la Costa and Serranía del Interior. The northern belt extends from Margarita passing through the north of Caracas to the west, north of the mountains of Puerto Cabello-Santa María (Yaracuy State); the second strip extends from the Araya-Paria Peninsula, in a westerly direction, passing through the Santa Lucía basin, Charallave, Loma de Hierro, Villa de Cura, San Juan de los Morros, Tinaquillo and Cabimba. Outside these two belts, serpentized peridotites are found in the Paraguaná Peninsula (Cerro Santa Ana) along the mountainous front of the Serranía del Interior and north of the Yaracuy river valley.*

*The large masses of Loma de Hierro and Tinaquillo are the only intrusions that have been systematically studied to determine reserves and content of nickel ores.*

*Aragua State, Loma de Hierro Region: the mass of serpentinized peridotite outcrops about 20 km south of Tejerías, forming a continuous body that extends for more than 21 km in a direction N 70 E, from about 4 km to the west of the Tiara hamlet, up to the vicinity of Túcata, with a variable width between 1 and 5 km.*

*In the area of Loma de Hierro, the lateritic mantle covers an area of more than 600 ha and delimits the extension of the nickel deposit, whose average thickness is 6.36 m. The deposit, product of the in situ alteration of peridotite, is similar to the deposits exploited in Cuba, the Dominican Republic, Brazil, Guatemala, New Caledonia, the Philippine Islands and the Celebes Islands.*

*According to the evaluative works carried out throughout the area, the component parts of the lateritic mass of Loma de Hierro could be clearly differentiated. For cubination purposes, the lateritic level was divided into four zones based mainly on their physical characteristics and chemical variation, these zones are:*

**Zone 1:** *The upper part of the laterite is a red clayey mantle, with small Goethite-Limonite concretions and crusts. Despite being very porous, the specific weight of the material is high due to the iron content that varies between 35 and 45%.*

**Zone 2:** *This zone, composed of nickeliferous laterite, is reddish-yellow in color and underlies Zone 1. The laterite has a high moisture content and low specific gravity. The nickel has been concentrated by ionic precipitation of the penetration waters, in the form of Garnierite (hydrated silicate of Magnesium and Nickel) in laterite.*

**Zone 3:** *nickeliferous serpentinite, is the part between the base of the nickeliferous laterite and the upper contact of the weathered portion of the serpentinized peridotite mass that serves as the base for all lateritic bodies. It is an altered serpentine with a light greenish color, characterized by the development of fracture systems and a high degree of porosity. The nickeliferous ore is presented in the form of laminations and filled with joints and secondary porosities. The material is porous, with a low specific weight, high Nickel and Magnesium content and low iron content.*

**Zone 4:** *this zone includes peridotite with a high degree of more or less variable serpentinization. It has the initial nickel content, characteristic of peridotite (0.25%). It is not considered ore.*

*At Cojedes State, Tinaquillo area: investigations carried out have shown nickel enrichment in laterites produced from ultrabasic rocks.*

*The Tinaquillo peridotite is a mass that outcrops to the east of the Tinaquillo town and is mainly composed of peridotite, serpentinite and metagabbro in contact with acid dikes, metamorphosed quartzite and bands of pyroxynite and amphibolite. Four types of materials were considered in the investigation process: entrained lateritic material,*

*poorly drained in-situ lateritic material, well-drained in-situ lateritic material, and serpentinites”.*

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### **INTERNET REFERENCES**

Venezuela reported production of 17 000 t 2003, a 9.7% increase from the year before. Venezuela's first integrated nickel mine and ferronickel facility was

constructed by a consortium of foreign investors led by Anglo American (90.5%), Grupo Federal, International Finance Corporation – IFC and Jordex. The Loma de Niquel mine is located southwest of Caracas on the banks of the Mesia River. The deposit contains 34 Mt of mineable reserves that plans to produce 16 000t nickel (in ferronickel) per annum. The mine's proximity to nearby deepwater ports will greatly facilitate production, anticipated to begin in late 2000. 2001's production is expected to yield 11 000t of ferronickel. Anglo has an 91% interest in the Loma de Niquel lateritic nickel deposit situated southwest of Caracas.

<http://www.mbendi.co.za/indy/ming/nkcb/sa/ve/p0005.htm#5>

- **Loma de Niquel Nickel Mine, Venezuela**

Loma de Niquel Nickel Mine is an operating open pit mine in Venezuela. It mainly produces nickel and cobalt. In Raw Materials Data you will find production data for nickel for 5 years, between 2000 and 2004. In Raw Materials Data you will find production data for nickel for 5 years, between 2000 and 2004. It is controlled/owned by [Anglo American plc](#)

Loma de Niquel Nickel Mine is just one of 17 000 entities to be found in Raw Materials Data, the mining industry's most extensive database. Below is an example of what can be pulled out of Raw Materials Data.

<http://www.rawmaterialsgroup.com/RMDEntities/L/LOMAbb.htm>

- **Nickel**

Minera Loma de Niquel has control of Loma de Hierro, a nickel and smelting project that was based on proven and probable ore reserves of 34 million tons averaging 1.48% nickel, with a 27-year mine life. The accumulated investment up to day is estimated at some USD 417 million, and an investment of up to USD 83 million is expected in the next four years, with an estimated annual output of 1.2 million MT.

<http://strategis.ic.gc.ca/epic/internet/inimr-ri.nsf/en/gr113965e.html>

Venezuela



## Loma de Níquel (Base Metals)

Loma de Níquel is a lateritic nickel deposit discovered in 1941, located 80 km south-west from Caracas, Venezuela. Anglo American's involvement in this deposit started in 1992 when an option agreement was entered into.

Shareholding: 91%

<http://www.angloamerican.co.uk/ourbusiness/thebusinesses/base/geographiclocations/>

## Future Nickel Supply - New Production by 2005 (000s of tonnes)

Goro, New Caledonia	35
Laterite producers, Australia (Murrin Murrin, Bulong)	33
Cerro Matoso, Colombia (BHP Billiton)	27
Falconbridge, Norway	17
Loma de Níquel, Venezuela (Anglo American)	16
Rustenberg, South Africa (Anglo American Platinum)	13
Sumitomo, Japan	12
SLN, New Caledonia/France	11
Other*	6
	<u>170</u>

\* "Other" includes net changes to production levels at other operations

[http://www.inco.com/investorinfo/presentations/pdf/PT\\_inco\\_presentation\\_june\\_02.pdf](http://www.inco.com/investorinfo/presentations/pdf/PT_inco_presentation_june_02.pdf)



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<http://www.infomine.com/companiesproperties/map/googlemapproperty.asp?pid=24473>

- Venezuela increases the production of nickel at Loma de Niquel

<https://news.metal.com/newscontent/100067919/venezuela-increases-the-production-of-nickel-at-loma-de-niquel/>

- Nickel Mine in Loma de Hierro, Venezuela | EJAtlas

<https://www.ejAtlas.org/conflict/loma-de-hierro>







- **Venezuela restarts nickel output at asset taken over from Anglo**

<https://www.reuters.com/article/venezuela-mining-nickel-idUKL6N0U13KI20141217>

- **Nickel Ore in Venezuela**

<https://oec.world/en/profile/bilateral-product/nickel-ore/reporter/ven>

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<http://www.eoicaracas.gov.in/docs/Mining%20Sector.pdf>

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[http://www.venezuelaemb.or.kr/english/e\\_economy.asp](http://www.venezuelaemb.or.kr/english/e_economy.asp)

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