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Brazilian Mineral Potential: An Overview

24th World Mining Congress

Onildo João Marini
ADIMB

Rio de Janeiro, October 18, 2016

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OVERVIEW OF THE BRAZILIAN GEOLOGY

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Diversified geology, from Archean to Holocene, with several fertile volcano-sedimentary, volcanic and plutonic sequences (ultrabasic, basic and acid).

*** Has two mega geographic/geologic environments: Amazonian (West) and Atlantic (East).**

*** The Atlantic (Atlantic Shield) has orogenetic belts of Neoproterozoic age (Brazilian) at the craton borders.**

*** The Amazonian with Central Brazil and Guianas shields experienced extensive acid volcano-plutonism of Paleoproterozoic age and was not affected by the Brazilian orogeny.**

***Presents Proterozoic sedimentary basins in the Atlantic and Central Brazil shields.**

*** Has three large Phanerozoic sedimentary basins (sineclisis): Paraná, Amazonas, Maranhão.**

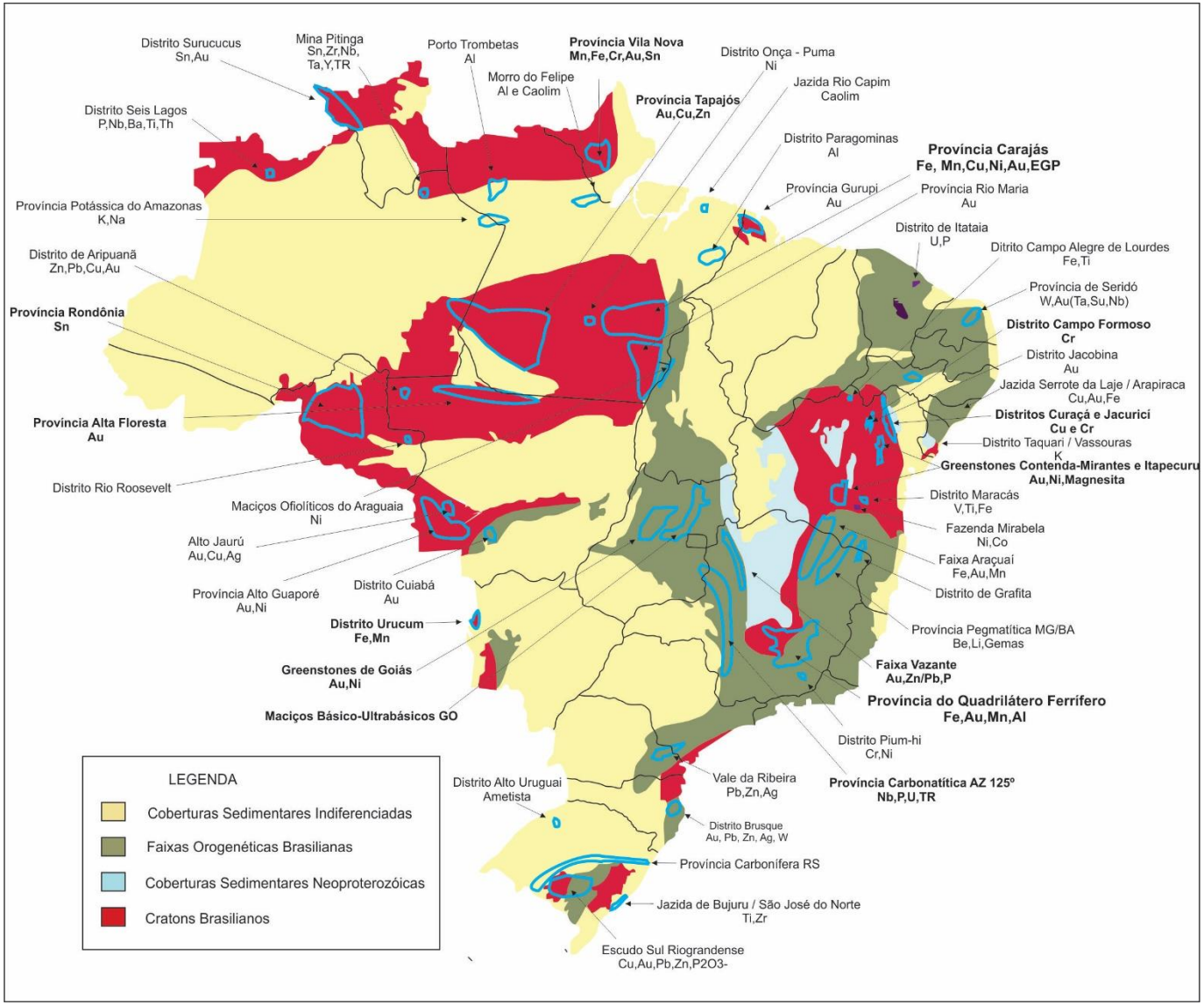
*** Was room to Cretaceous taphrogenetic tectonism in the Atlantic border, with formation of sedimentary basins in the continent and in the continental platform.**

*** Has Cretaceous/Tertiary sedimentary basins in the platform and in the continental slope.**

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BRAZILIAN GEOTECTONIC SKETCH AND MINERAL PROVINCES

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Two BRAZIL: Amazonic and Atlantic

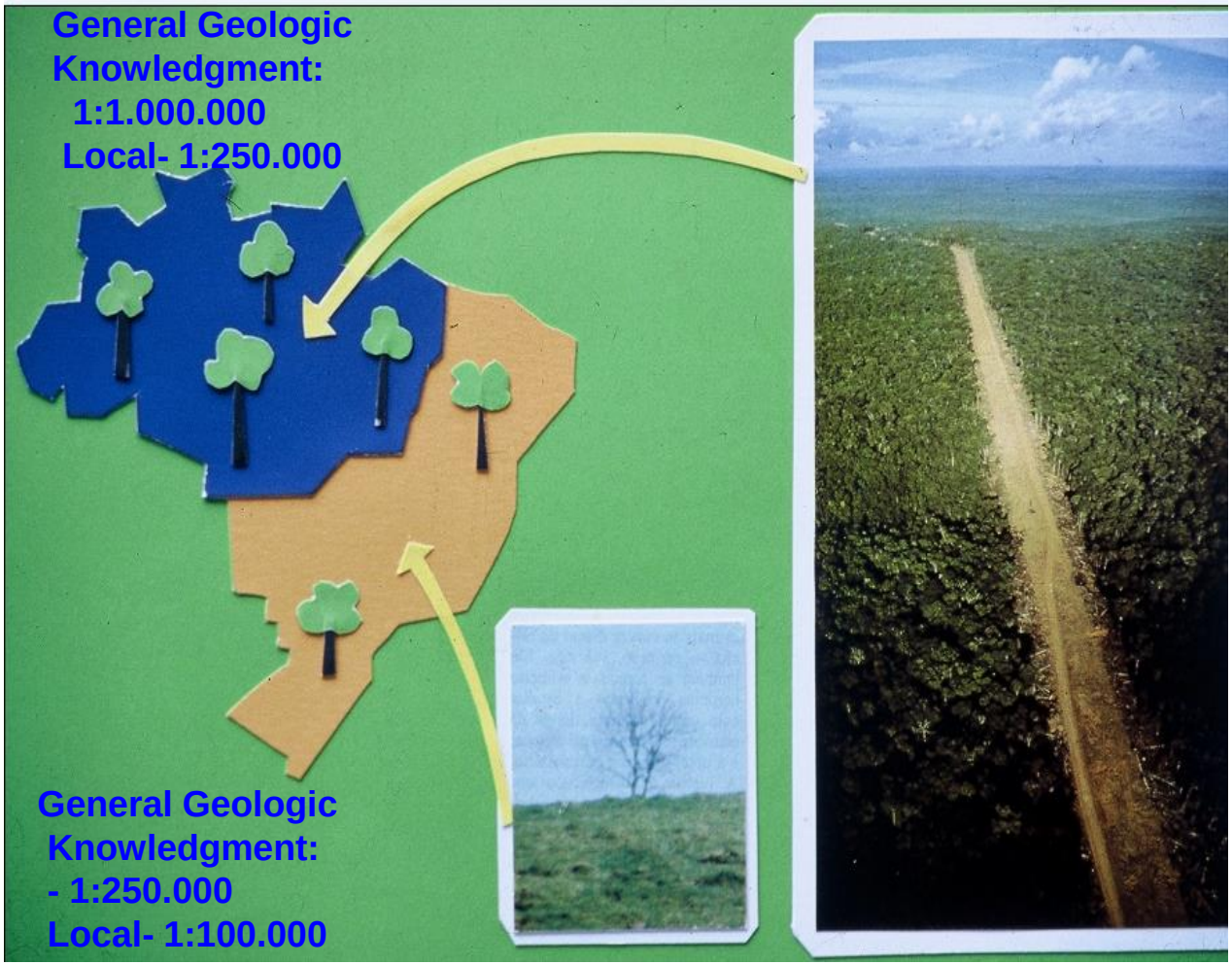
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AMAZONIC – Jungle

- Rain forest climate
- Bad infrastructure
- Low populated
- Few geologic data
- Few big mines, many "garimpo"
- 60% of the territory

ATLANTIC – Open

- Bush, semi desertic and Atlantic forest
- Highly populated
- "Good" infrastructure
- "Good" geologic information
- 40% of the territory



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MAIN BRAZILIAN METALLOGENETIC ENVIRONMENTS

- Archean and Paleoproterozoic Greenstone belts (MG, BA, GO, PA, MA, RN): Au, Ni, Mn, Cr, Fe, Magnesite.
- Neoarchean volcano-sedimetary sequences (PA, AM): Fe, Cu, Mn, Au, Pt/Pd.
- Paleoproterozoic sedimentary sequences with BIF (MG): Fe, Mn, Au.
- Proterozoic sedimentary sequences (AM, PA, MG, BA): Au, Fe, Diamond.
- Basic-ultrabasic Proterozoic massifs (GO, BA, PA, AM, TO, RO): Ni, Cu, Cr, Zn, V, Ti, PGE, Asbestos.
- Proterozoic felsic volcano-plutonic complexes (GO, MT, RR, PA, AM, RN): Au, Sn, Cu, Zr, U, Zn, Ta, Li, Be, W, REE.
- Neoproterozoic sedimentary sequences with BIF (MS): Fe, Mn.
- Neoproterozoic orogenetic belts (RS, SC, PR, SP, MG, BA, SE, AL PE, PB, RN, GO, DF, TO , MS, MT, PA): Au, Zn, Pb, Mn, Ta, P.

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MAIN BRAZILIAN METALLOGENETIC ENVIRONMENTS

- Neoproterozoic sedimentary coverages (MG, BA, MT): Zn, Pb, P, Barite.
- Paleozoic sedimetary (sineclisis) basins (RS, SC, PR, SP, GO, MS, MA, PI, TO, BA, AM, PA, AC, AP): Coal, U, Gipsite, K.
- Mesocenozoic sedimentary basins (BA, SE, AL, Continental Platform): K, Oil and Gas.
- Cretaceous alkaline-ultramaphic-carbonatites complex (SC, PR, SP, MG, GO, TO, MS, MT, AM): Nb, P, U, Fe, REE, Flogopite/Vermiculite.
- Cretaceous (RS, PR, MT, GO, MG, TO, RR, AM) and Precambrian (BA) Kimberlite pipes: Diamond.
- Cretaceous and Post-cretaceous lateritic weathered mantles (MG, GO, TO, MT, PA, AM, MA...): Au, Al, Mn, Ni, Nb, REE, Fe.
- Quaternary alluvium and beach placers (all the country): Au, Sn, Ta, Ti, Th, Zr.

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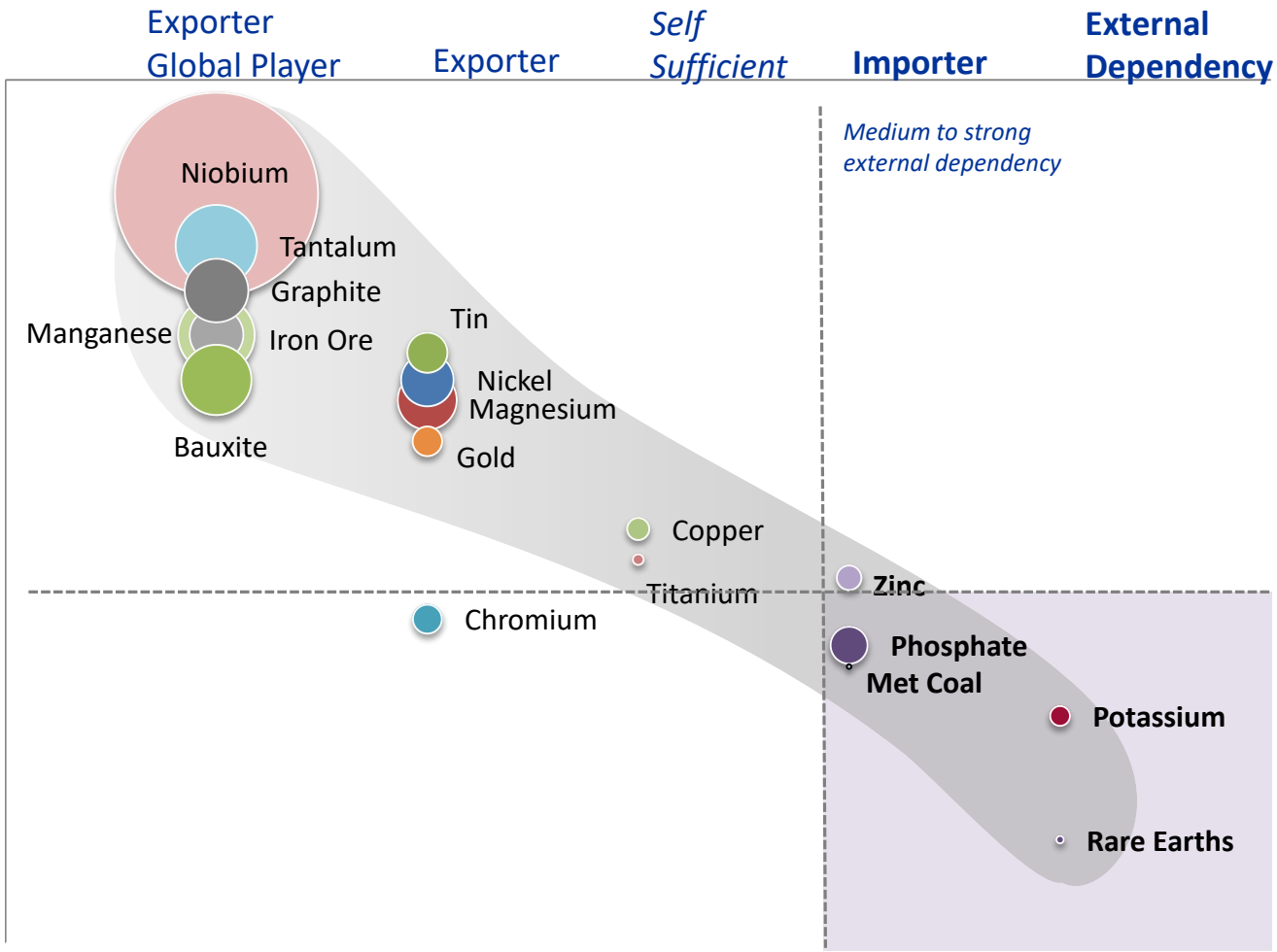
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LARGE AND MEDIUM SIZE METAL COMMODITIES MINES AND PROJECTS - 2013

Mines larger than 100.000 ton/year-ROM

States	Mines	Projects
Minas Gerais	67	34
Pará	12	95
Bahia	10	40
Goiás	12	34
Mato Grosso	3	4
Mato Grosso do Sul	4	1
Total in Brazil	130	309

MAIN MINERAL COMMODITIES IN THE BRAZILIAN MARKET



Source: IBRAM, DNPM, USGS

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WORLD LATERITIC DOMAIN

A WIDE RANGE OF MINERAL EXPLORATION POSSIBILITIES:

Al, Au, Ni, Mn, Fe, Nb, P_2O_5

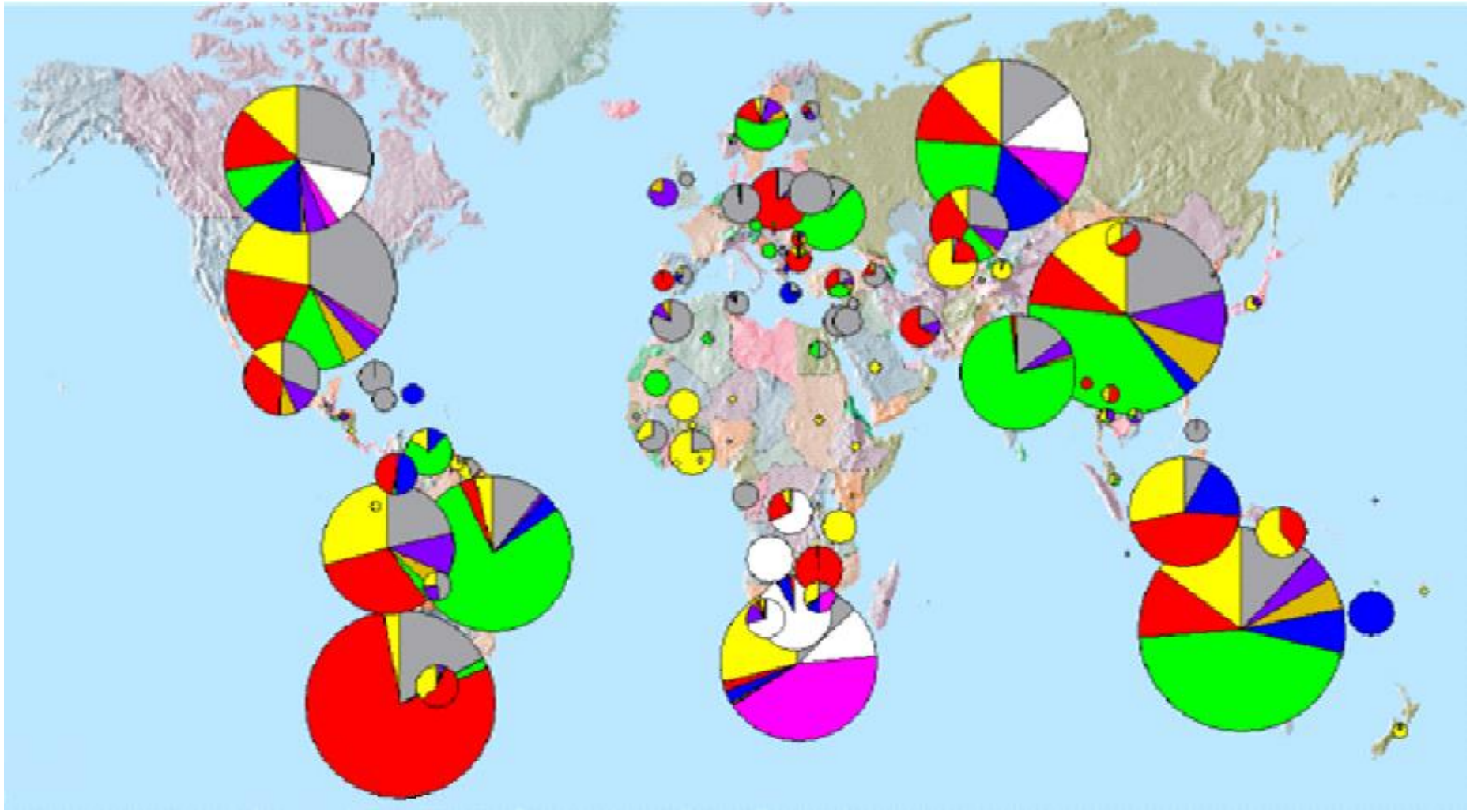


Source: VALE - ADIMB, PDAC 2011

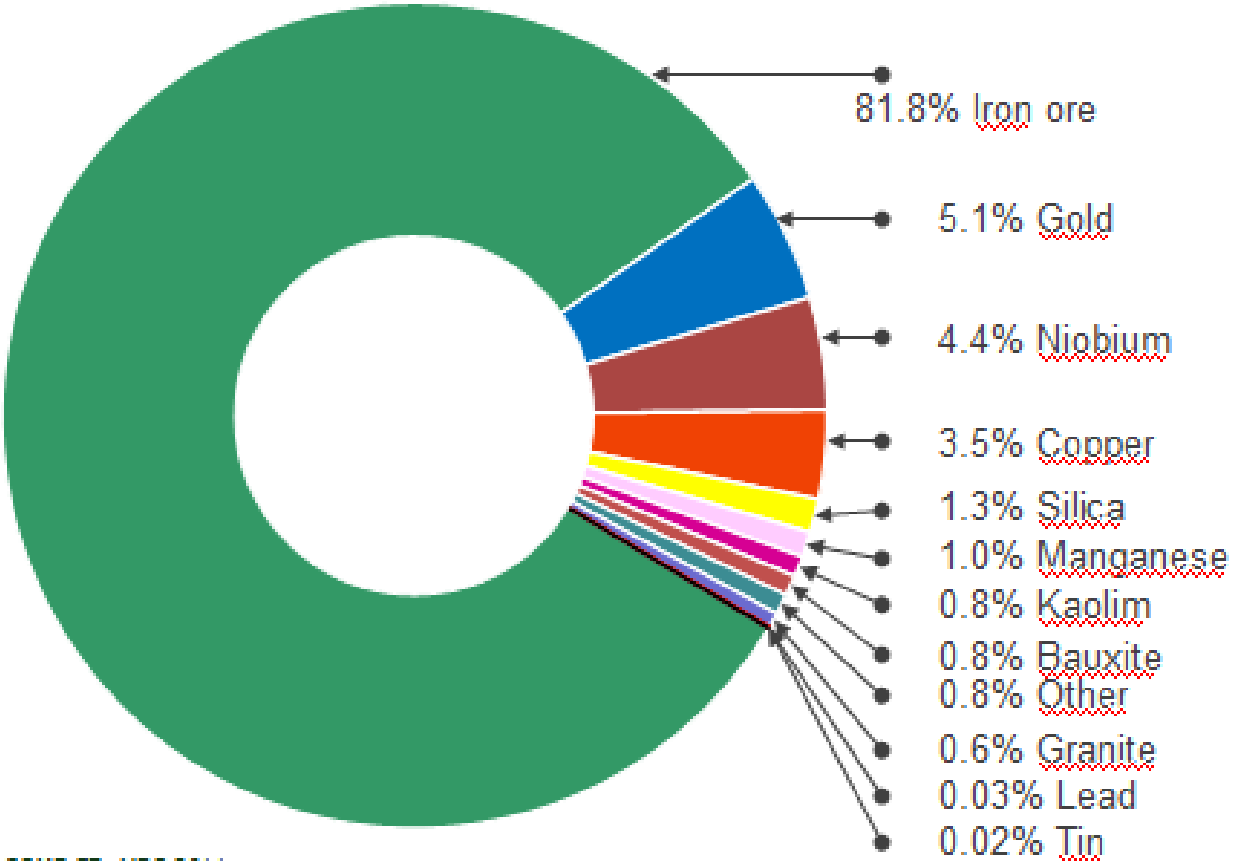
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DIVERSIFICATION OF MINERAL PRODUCTION IN EACH COUNTRY

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SHARE OF COMMODITIES EXPORTED by Value (US$)



SOURCE: MEG 2011

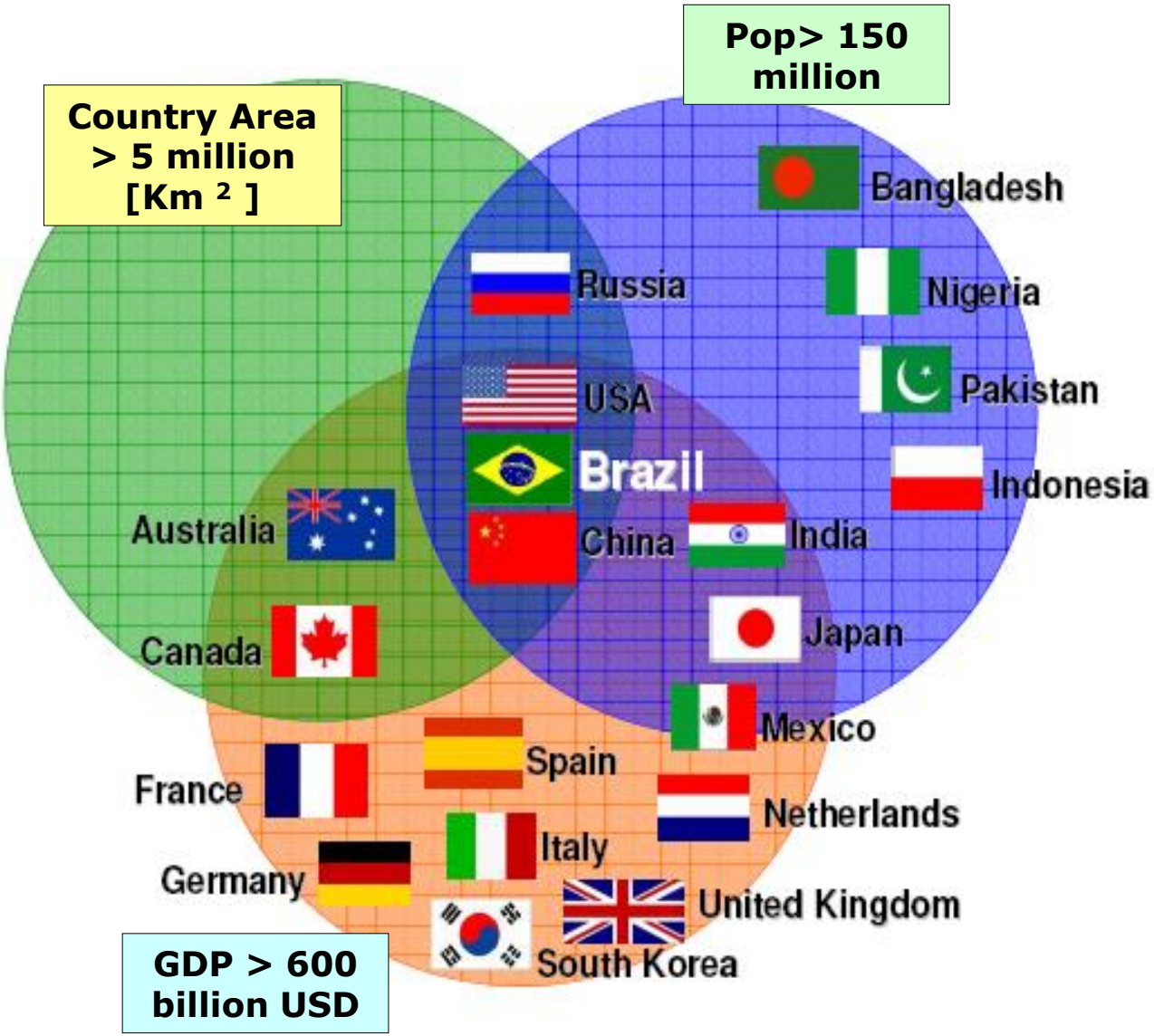
Commodity exports highly biased on iron ore

"Niche" commodities, like niobium, still largely underdeveloped

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BRAZIL IN THE WORLD (country size and economy)

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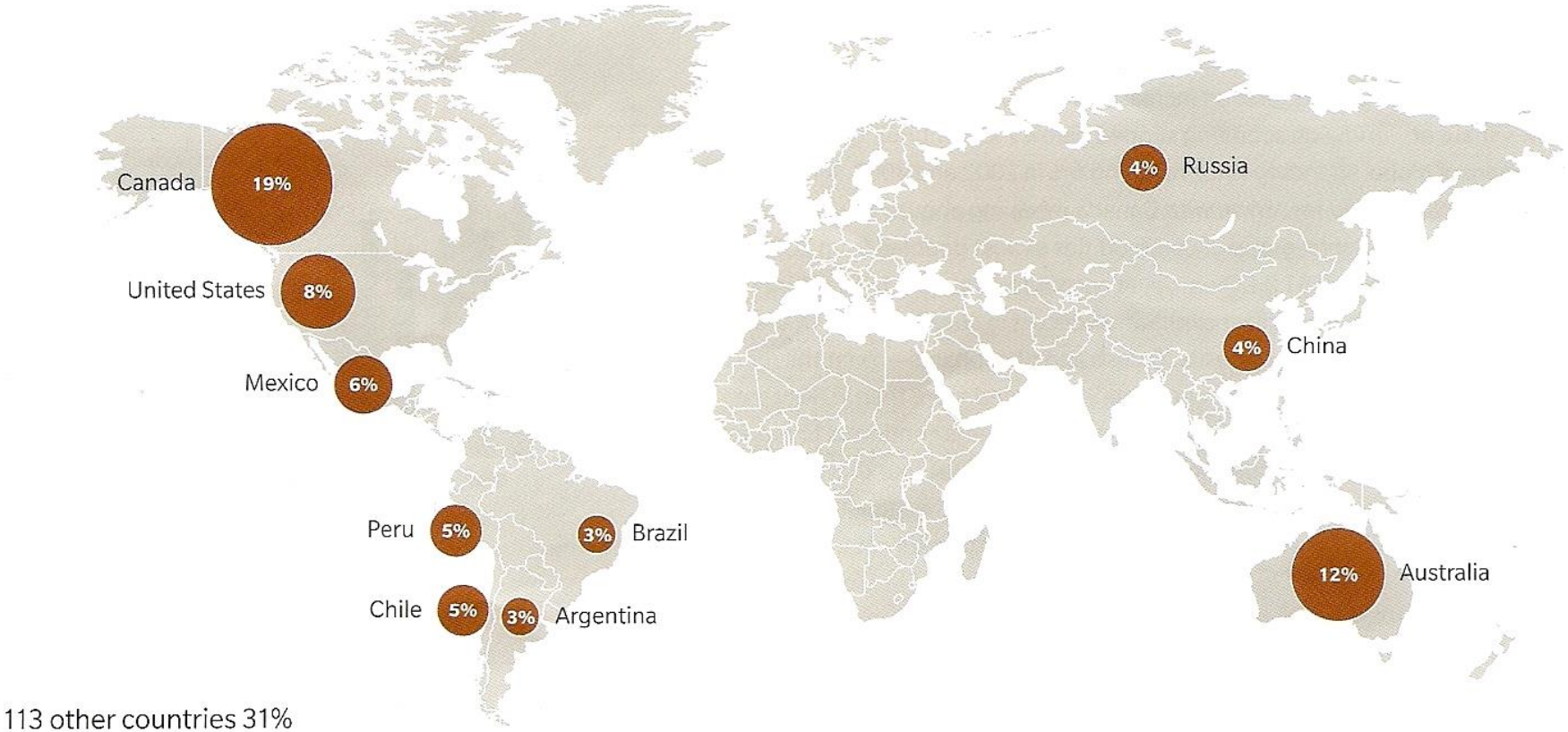


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10 TOP BUDGET DESTINATIONS FOR NONFERROUS EXPLORATION

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Figure 4: Exploration Budgets for the Top Ten Countries, 2010



113 other countries 31%

© Metals Economics Group, 2011

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COMPARISON
BRAZIL – CANADA - AUSTRALIA

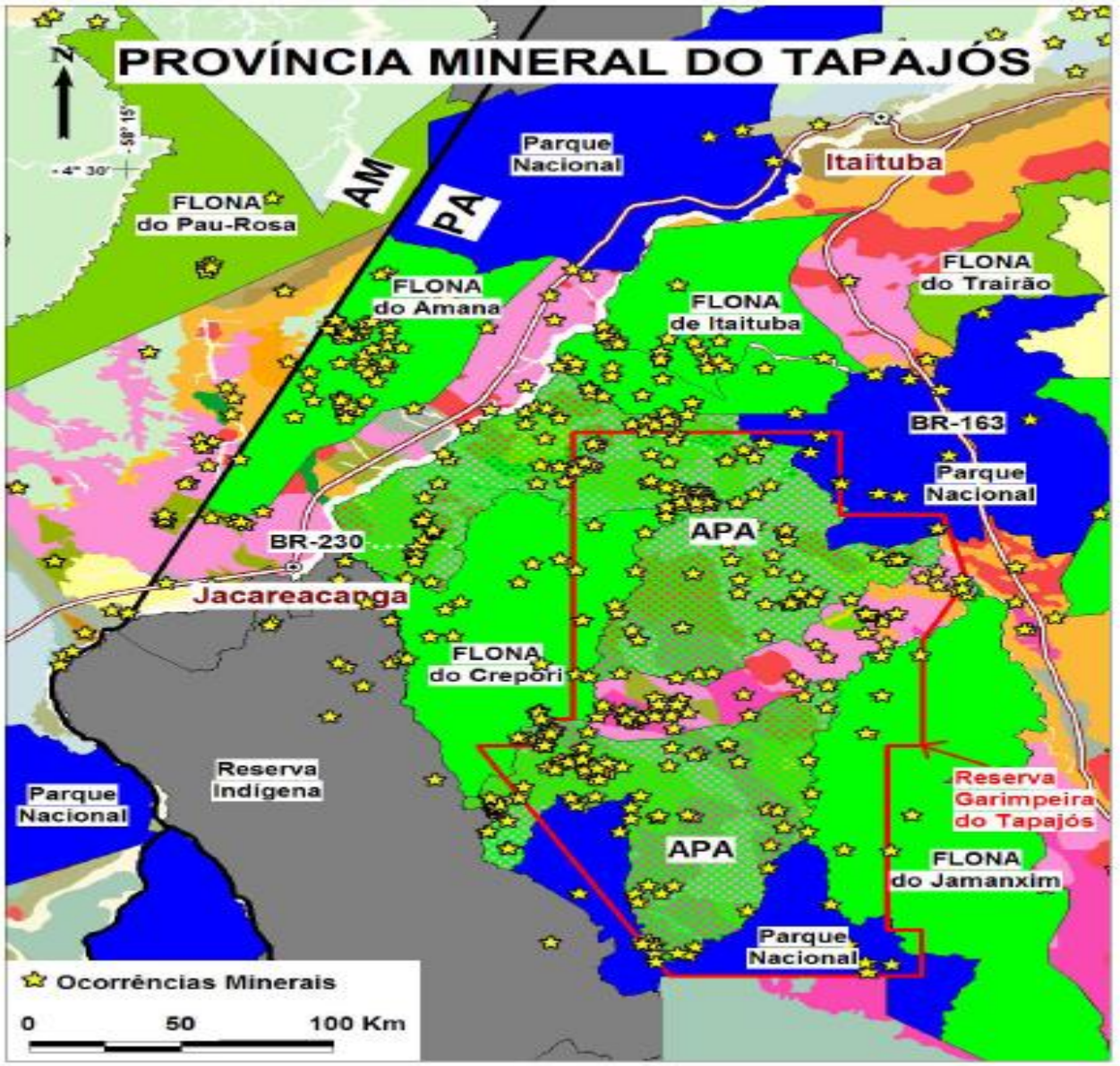


	Brazil	Canada	Australia
Area (10^6 km ^{2})	8,5	9,1	7,7
Precambrian shield (10^6 km ^{2})	2,2	1,2	2,5
Productivity Au kg/Km^2 (1969-1990)	0,9	3,4	5,7
Exploration Expenditures, 2013 (10^6 US$)	645	4.968	2.963

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TAPAJÓS MINERAL PROVINCE - PA



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CONCLUDING REMARKS

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Brazil has:

- Continental area
- Well-endowed geological environment
- Historically underexplored
- Mineral provinces known only in surface
- High possibility for supergenic deposits
- New high quality geophysical data
- Society friendly to mining
- Politically stable, with reliable regulatory systems. New Mining Framework (?)

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"Let none of us forget that ore deposits are first found in the mind: humble minds, minds thirsting for new knowledge and new understanding, minds not afraid to embark on adventures in new ways of thinking."

Roy Wooddall, 2005

THANK YOU!

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BOTTLENECKS TO THE DEVELOPMENT OF BRAZILIAN MINING

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- Lack of financing to mineral exploration
- Constraints to access possible areas: Conservation Units, Border Areas, Indigenous Areas, RENCA, Uranium
- Obstruction and slowness of state environmental institutions
- Low geologic knowledge of Mineral Provinces
- High Brazil Cost: energy, fuel, social contributions, taxes, among others
- Uncertain Legal Guarantee: New Mining Framework (?)
- Lack of encouragement and governamental partnerships
- Poor infrastructure
- Evasion of companies to other countries

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INTERNACIONALIZATION OF BRAZILIAN MAJORS

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