Indicator mineral methods in precious metal exploration

Indicator Mineral Methods in Mineral Exploration

Exploration07

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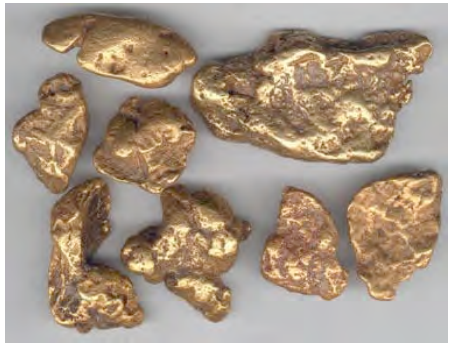
Indicator mineral methods in precious metal exploration

- Development of method
  - Focused on Au grains and less on accessory indicator minerals
    - Abundance and morphology
  - Linked to physical dispersal processes
    - Distance of transport
  - Consideration for chemical processes (fineness and inclusions)
- Environments of Application
  - Covered glaciated terranes
  - Tropical environments
  - Other environments?
    - define the problem first, then test



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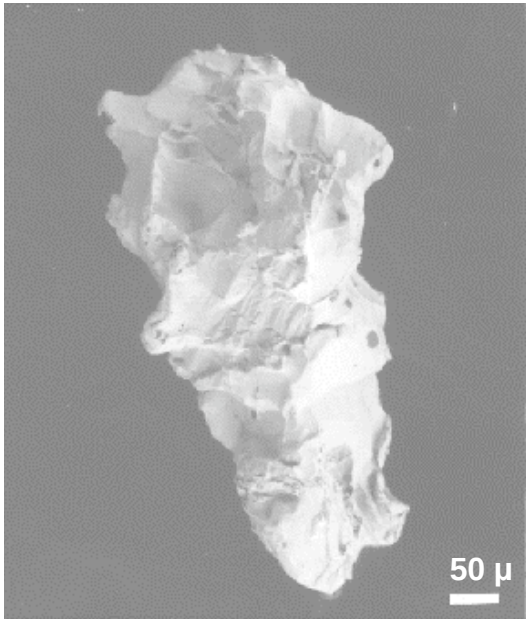
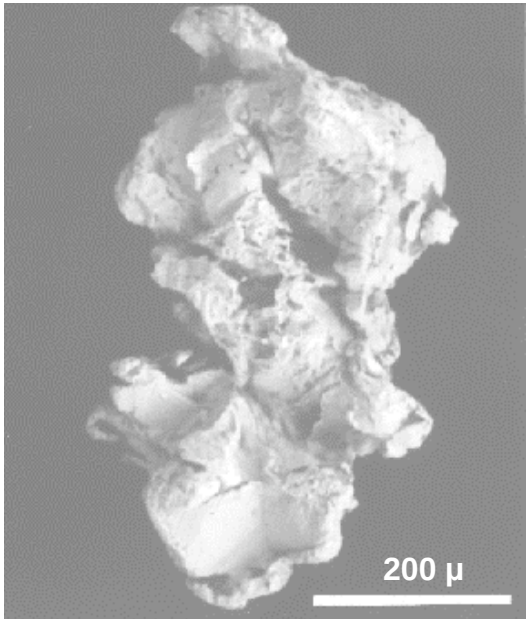
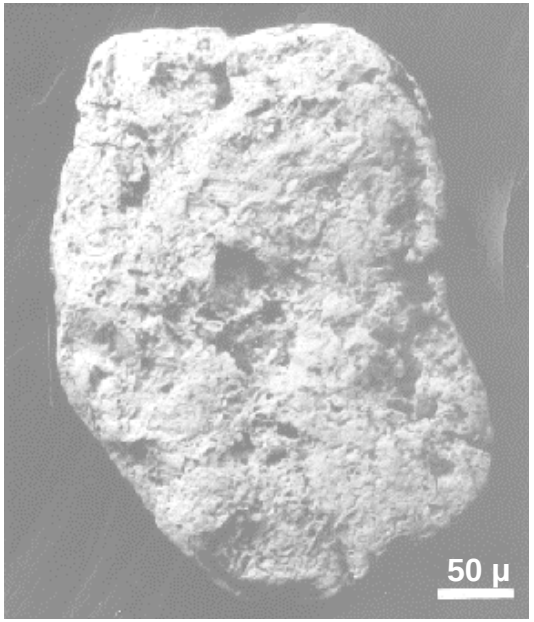
Till Gold Grain Morphology

Pristine	Modified	Reshaped
		
100 m	500 m	>1,000 to > 10,000 m

Distance of Transport

Courtesy CDM

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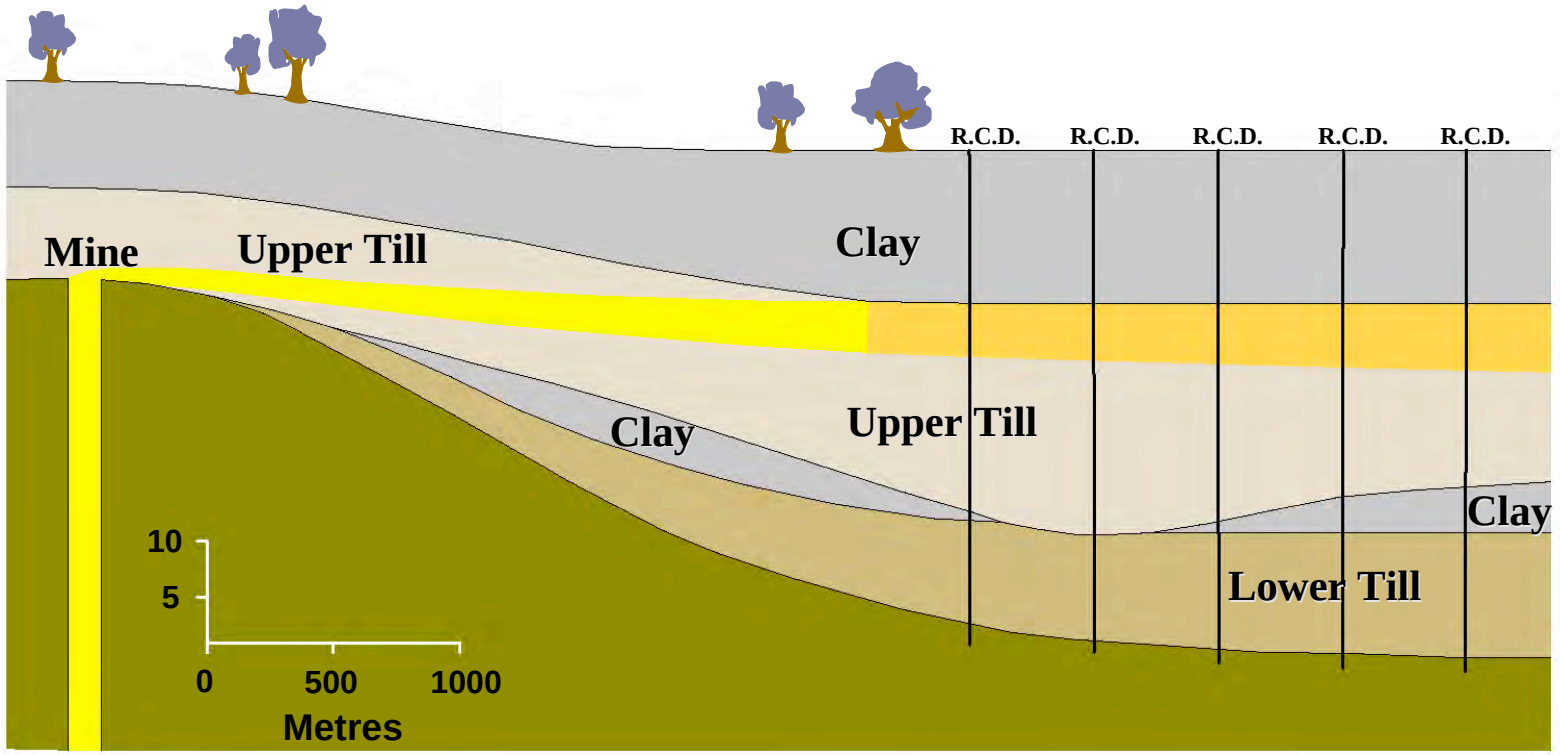
Physical Dispersal of Gold Grains
Simple or Complex?



Courtesy ODM

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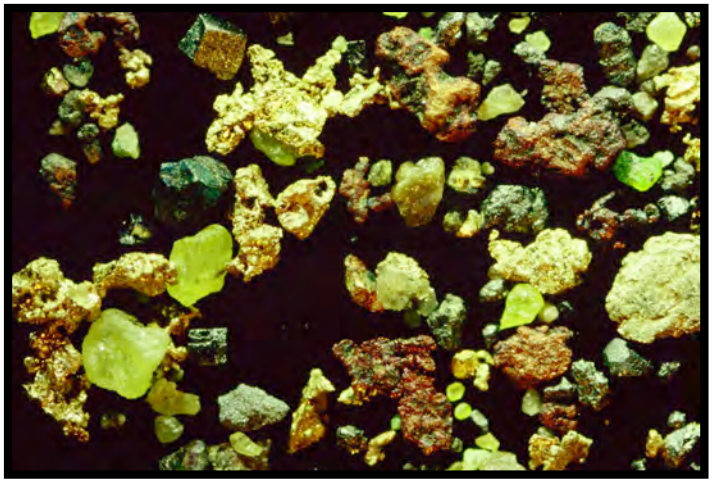
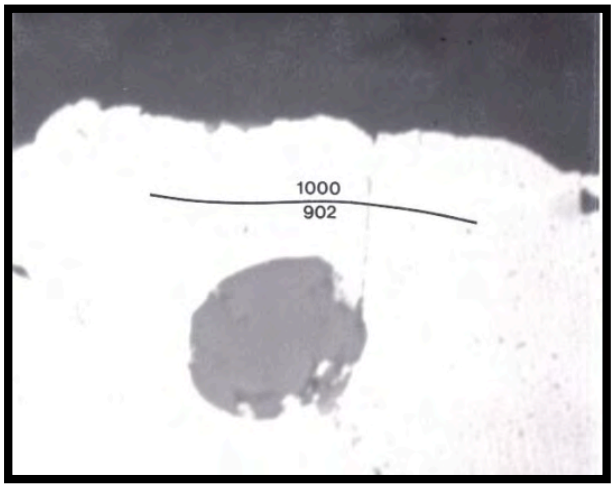
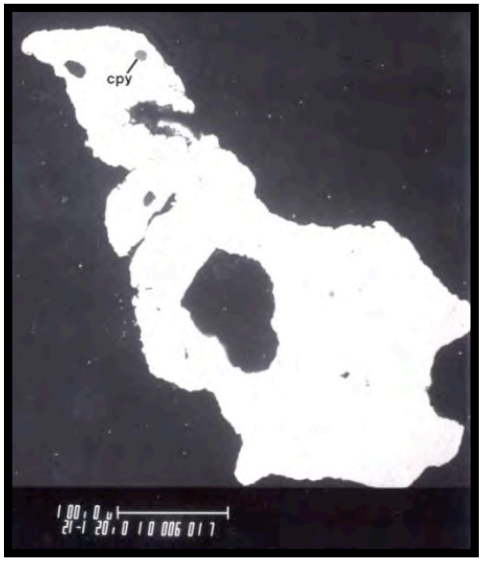
Other Important Characteristics







Associated minerals

Fineness of gold

Inclusions in gold grains

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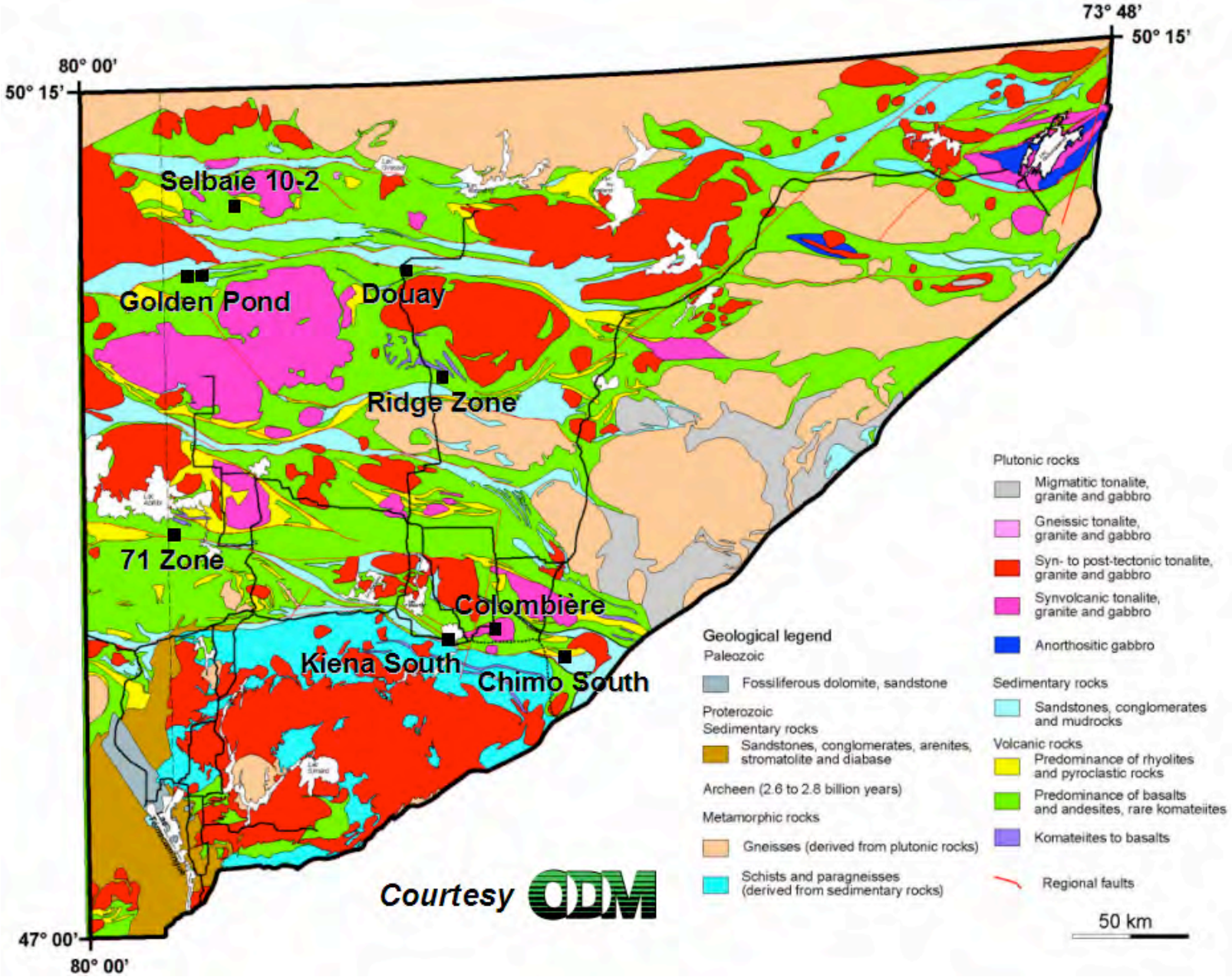
R.C. Gold Discoveries in Abitibi, 1984-1995



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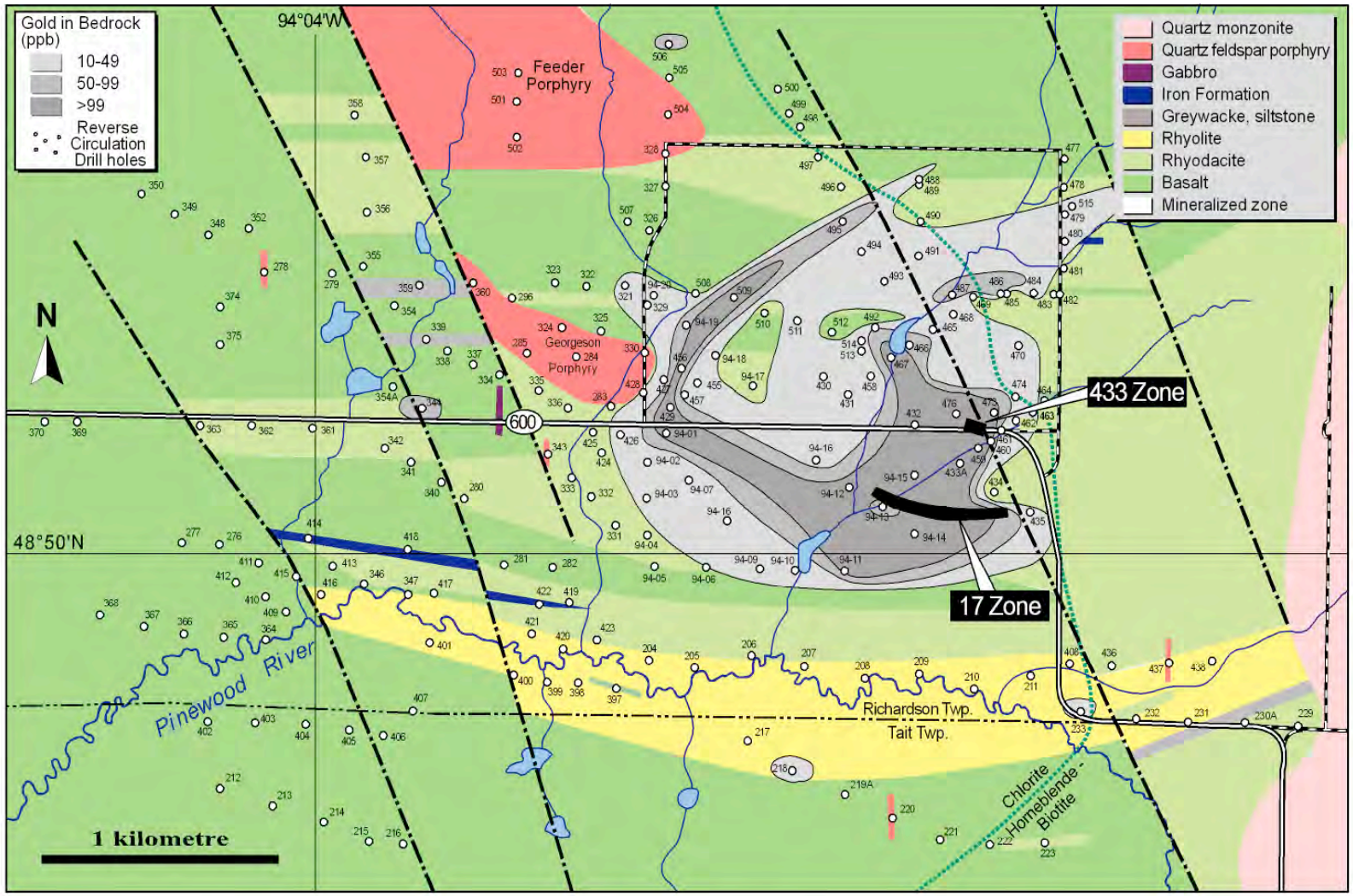
Gold Discovery - Rainy River, Ontario

Gold in bedrock



Courtesy ODM

Courtesy: Nuinsco

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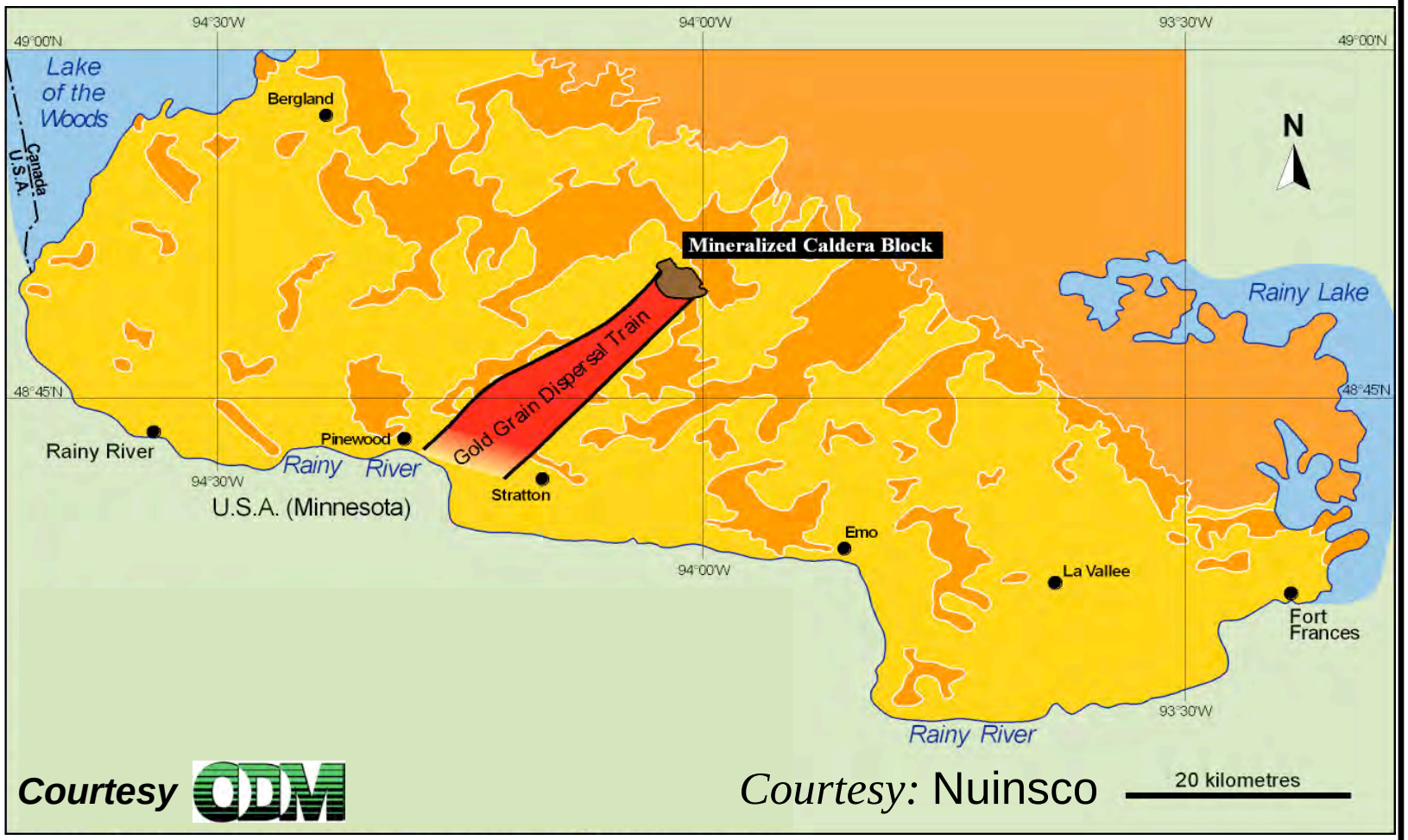
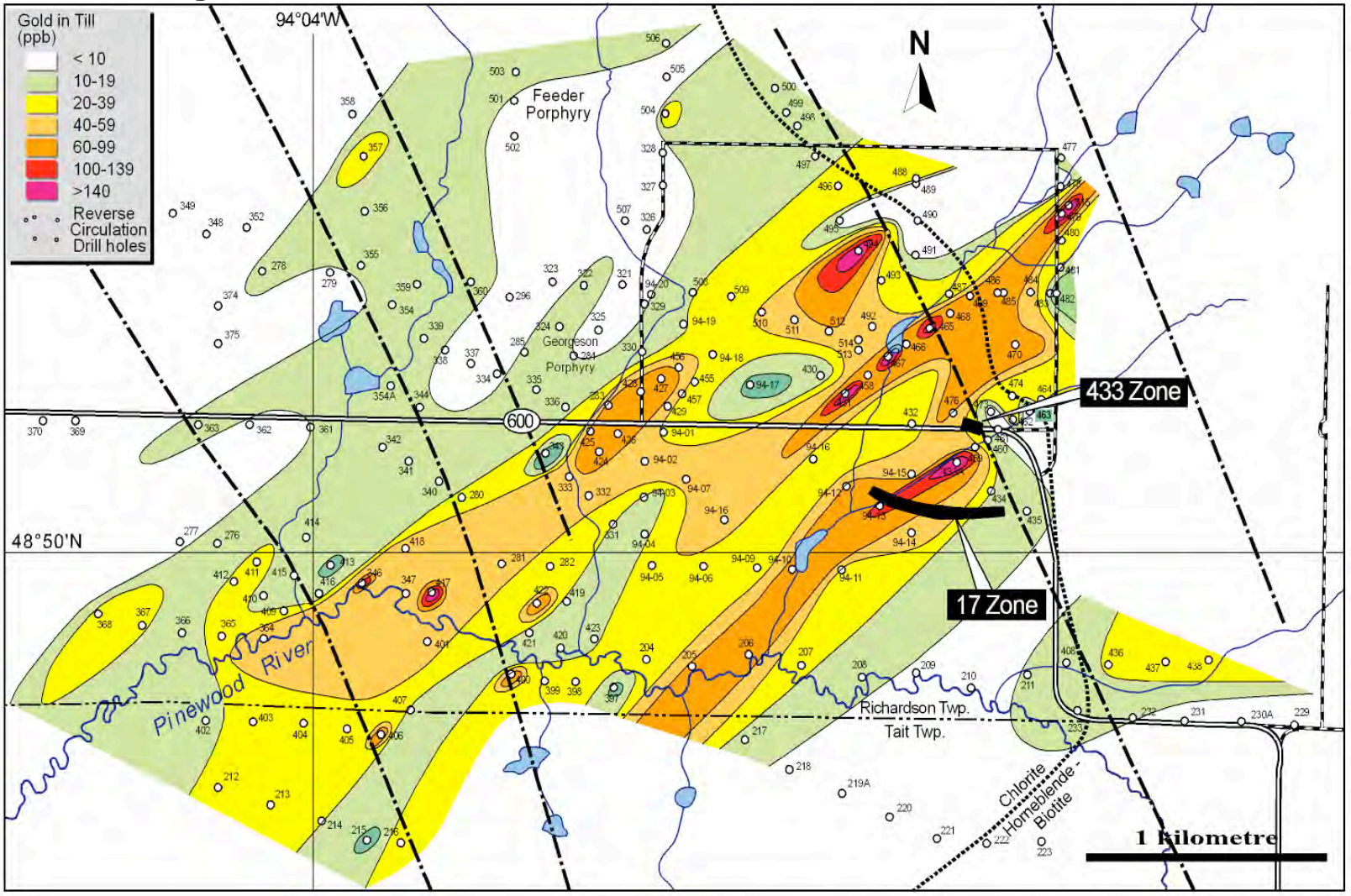
Regional Gold Grains in Till, Rainy River, Ontario



Detailed Gold Grains in Till, Rainy River, Ontario



Courtesy ODM

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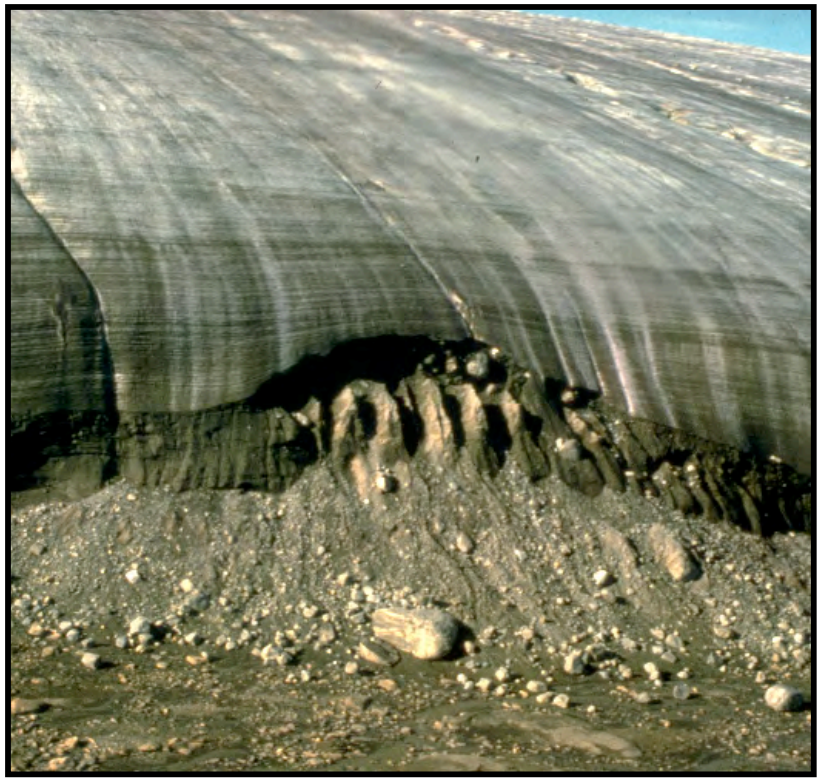
Application to Tropical Environments

What do these environments have in common?



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Application to Tropical Environments

Similarities with glaciated terranes.

Gold Survives

Canadian Inhabitants

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Tropical Environments

The Problem

- Extensive vertical weathering and erosion
- Surface accumulation of gold common in region
- Geomorphology of region is dynamic
- Lode source may not be in current placer drainage

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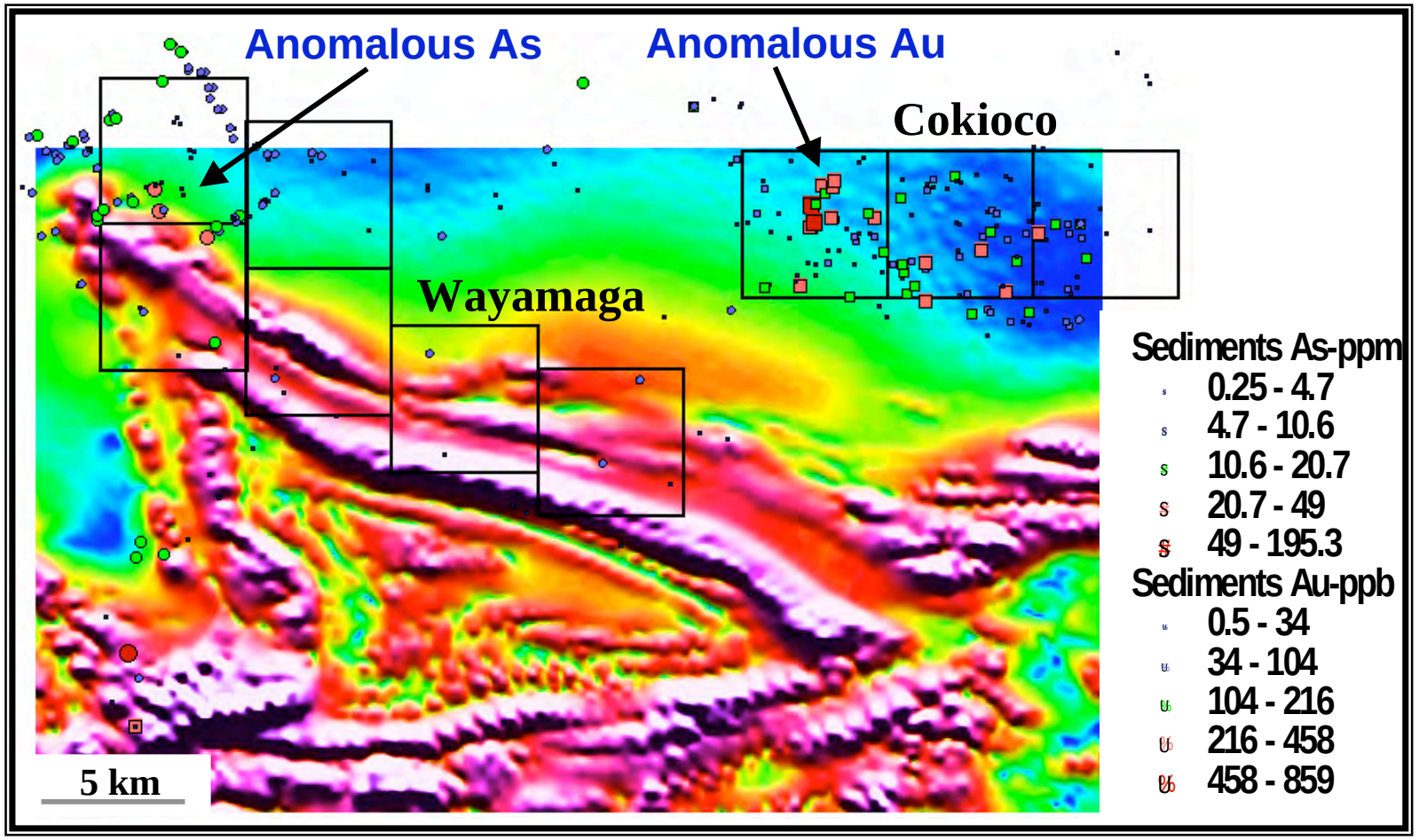
French Guiana – Wayamaga and Cokioco



Courtesy WMC (r.i.p.)

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Cokioco vs. Wayamaga

	Cokioco	Wayamaga
Load Source	Not present (>$1 million)	Present (<1$ spent)
Placer Mining	Evident	Evident
Au Grains	V. Significant	Low
HMC Au	V. Significant	Weak
Stream Sediment Au	Significant	Weak
Stream Sediment As	Weak	Strong

The problem – how do you distinguish Wayamaga from Cokioco without spending $1m?

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Gold Grain Study - Methods

- 10 kg panned to ~1 kg hmc
- Samples tabled and micropanned
- Examined by binocular microscope
- 0.25-0.5mm heavy mineral fraction extracted and logged
- Gold grains extracted and classified
- Suites of gold grains from two representative samples from each area examined by SEM and analysed by energy dispersive x-ray spectrometry
- All work done by ODM

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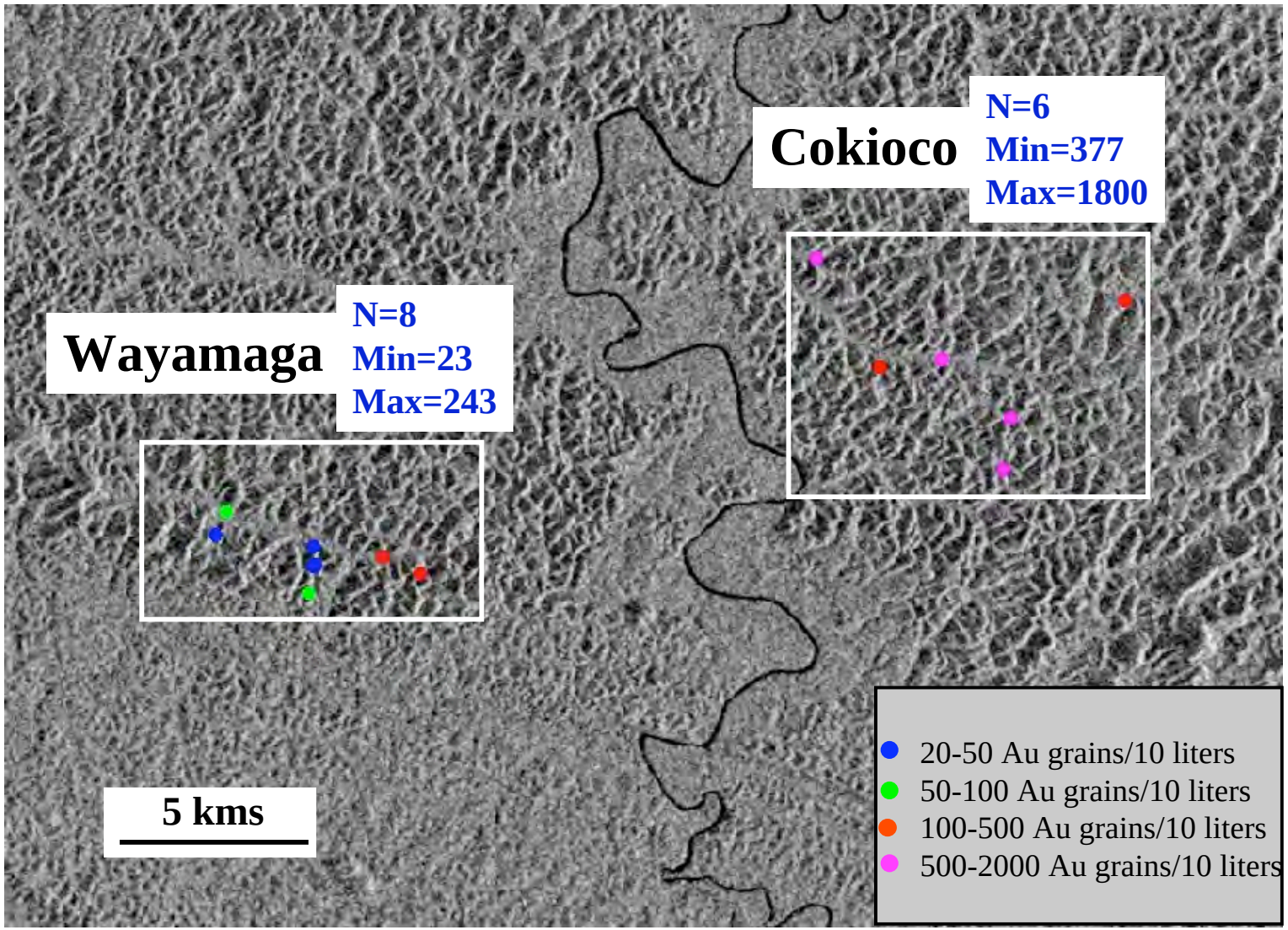
Gold Grain Study - Abundance



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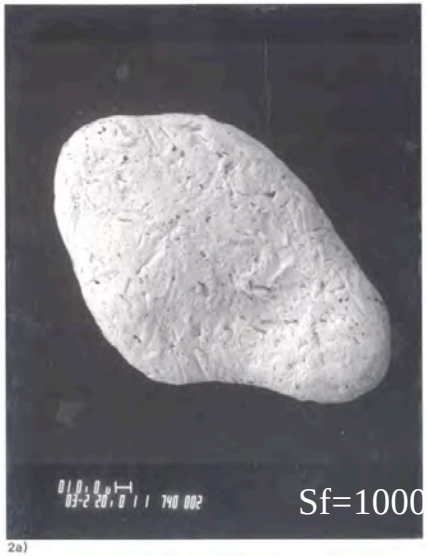
Gold Grain Study - Morphology

Cokioco fully reshaped gold grains



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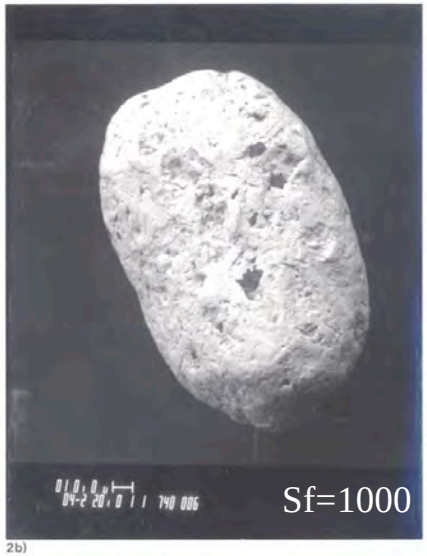

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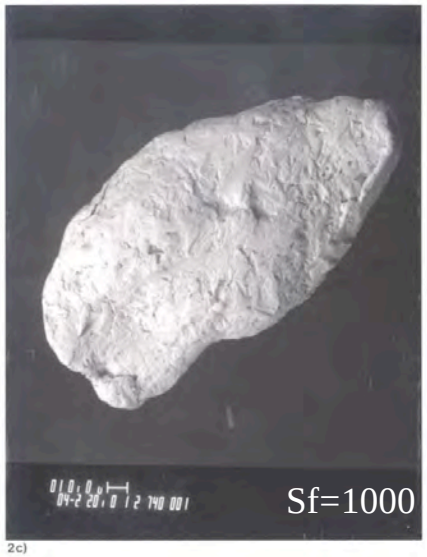

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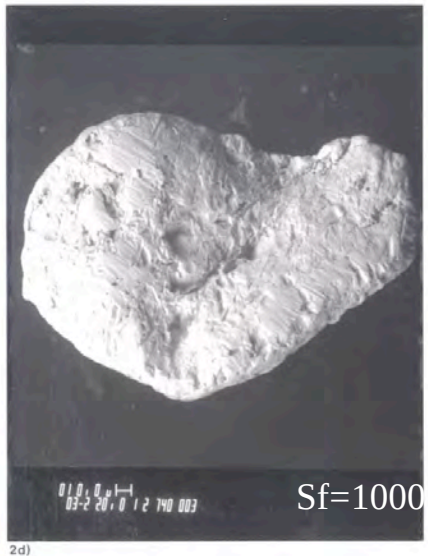

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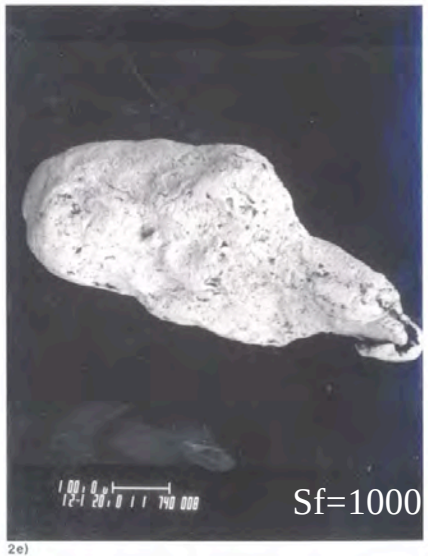

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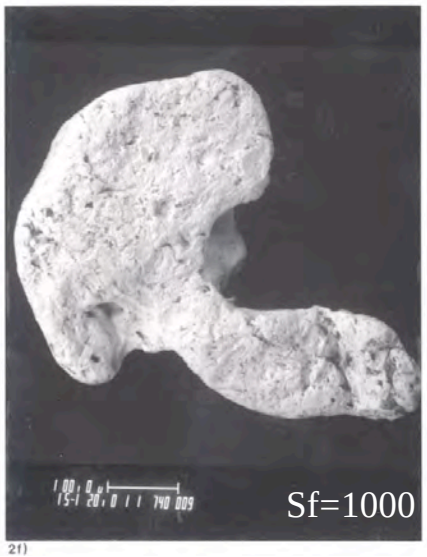

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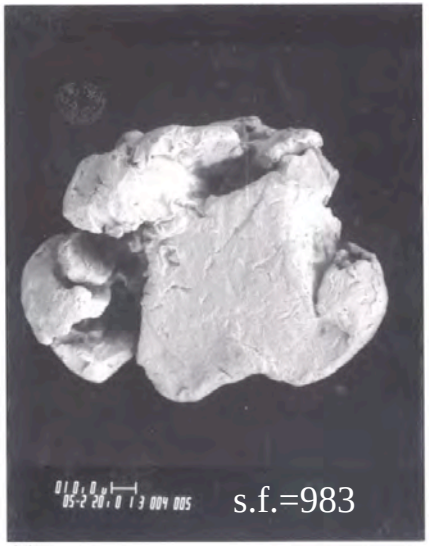
Gold Grain Study - Morphology

Wayamaga slightly modified to fully reshaped gold grains



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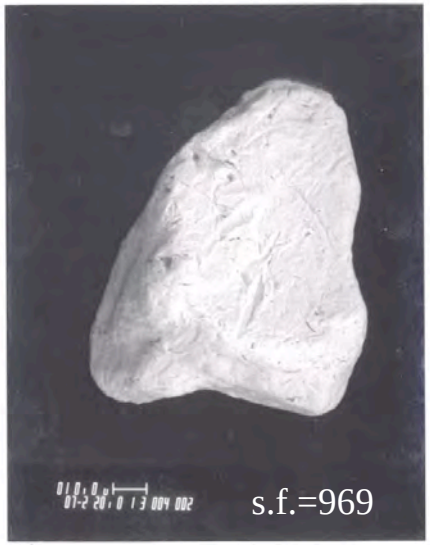

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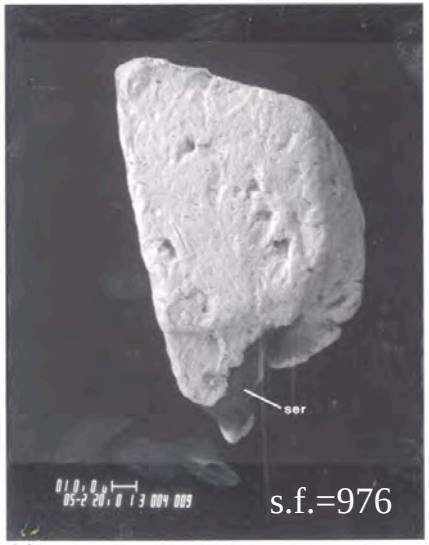

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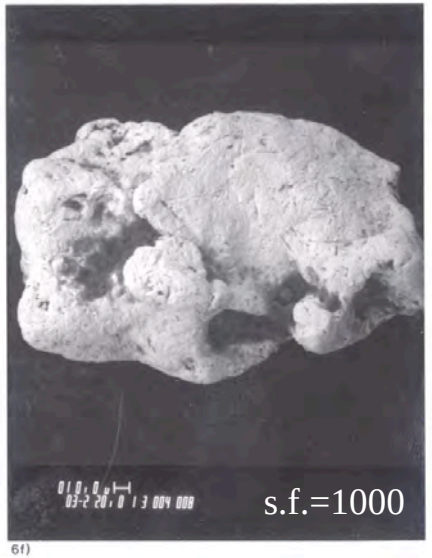

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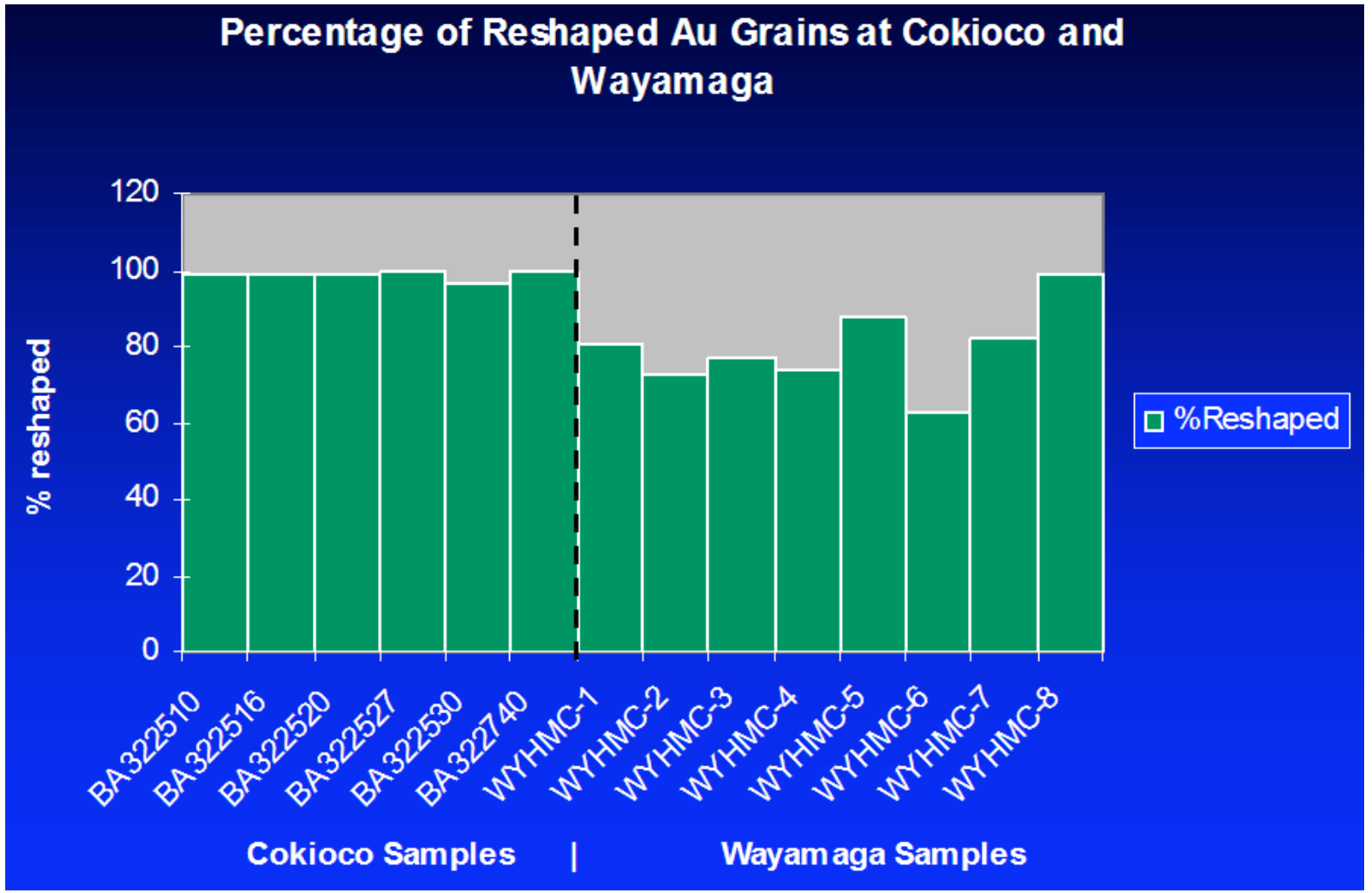
Gold Grain Study - Reshaping



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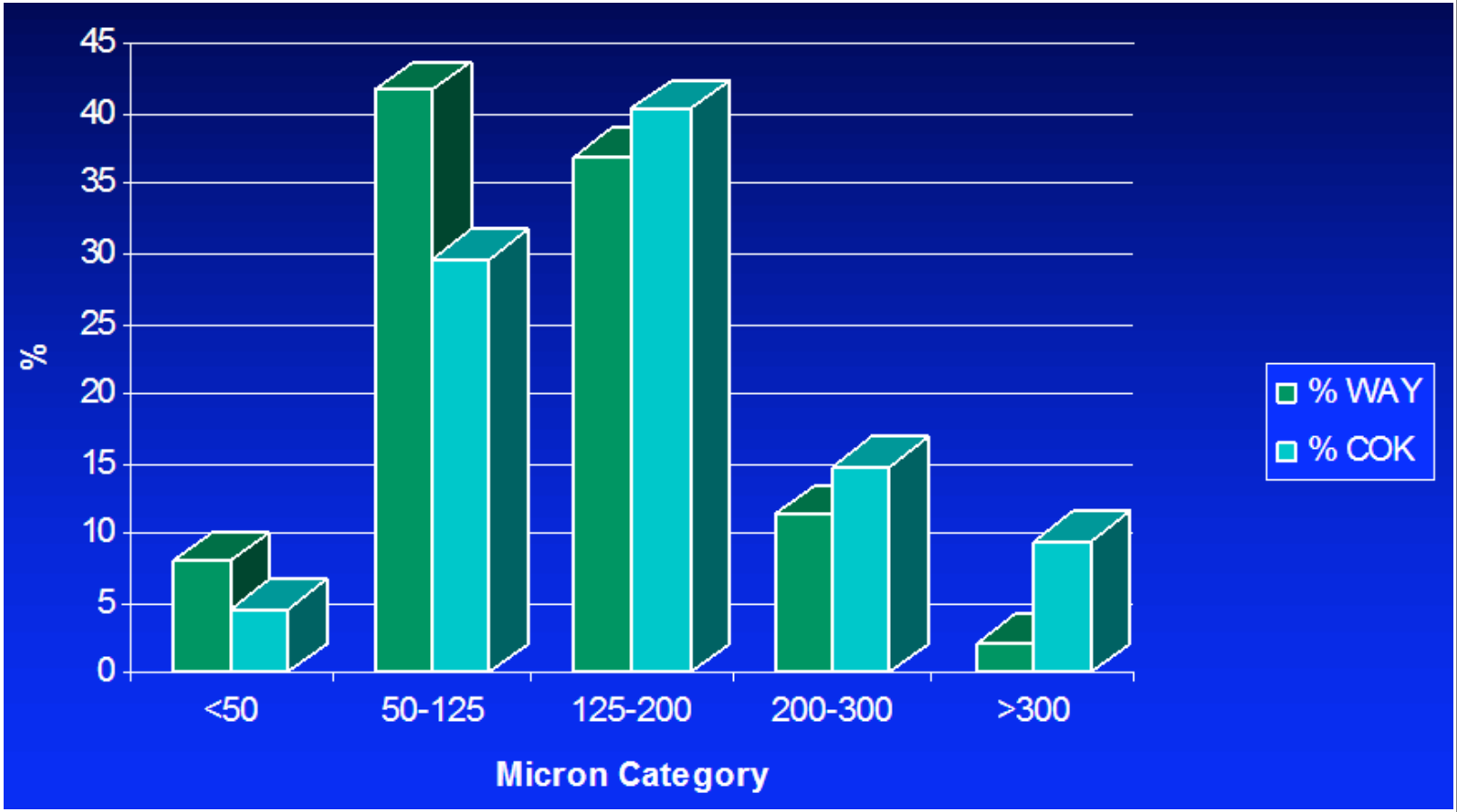
Gold Grain Size Distribution

Size Distribution of Gold Grains at Wayamaga and Cokioco



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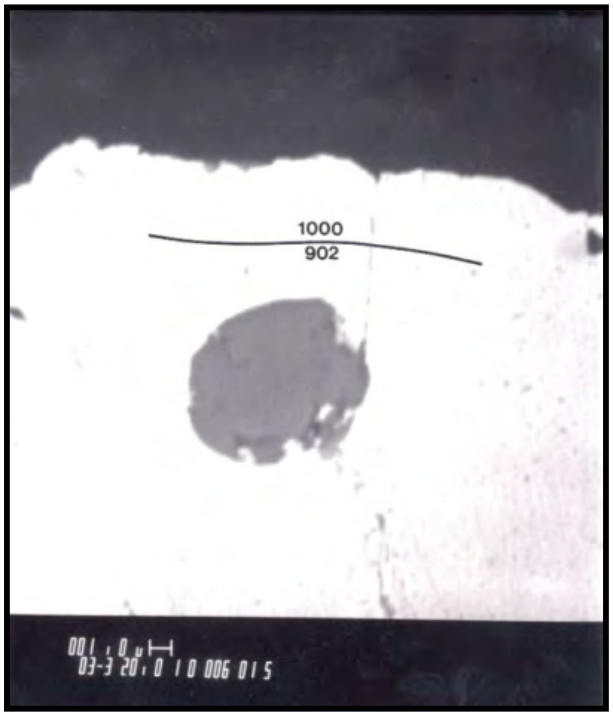
Fineness of Gold Grains

	Cokioco	Wayamaga
N =	59	56
Surface Fineness (average)	1000	988
Core Fineness (average)	1000	953



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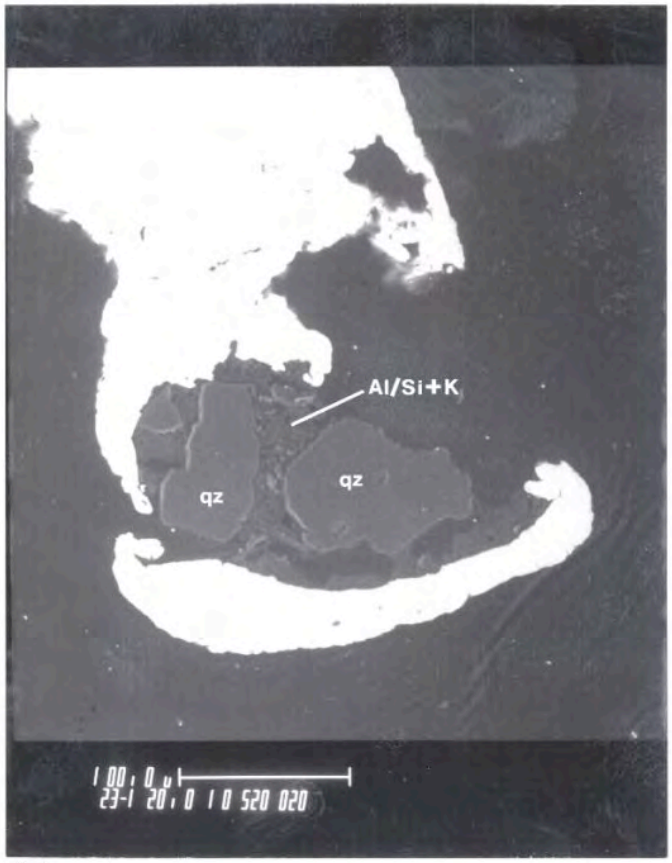
Inclusions and Entrained Minerals

Cokioco - presence of stable and/or entrained inclusions



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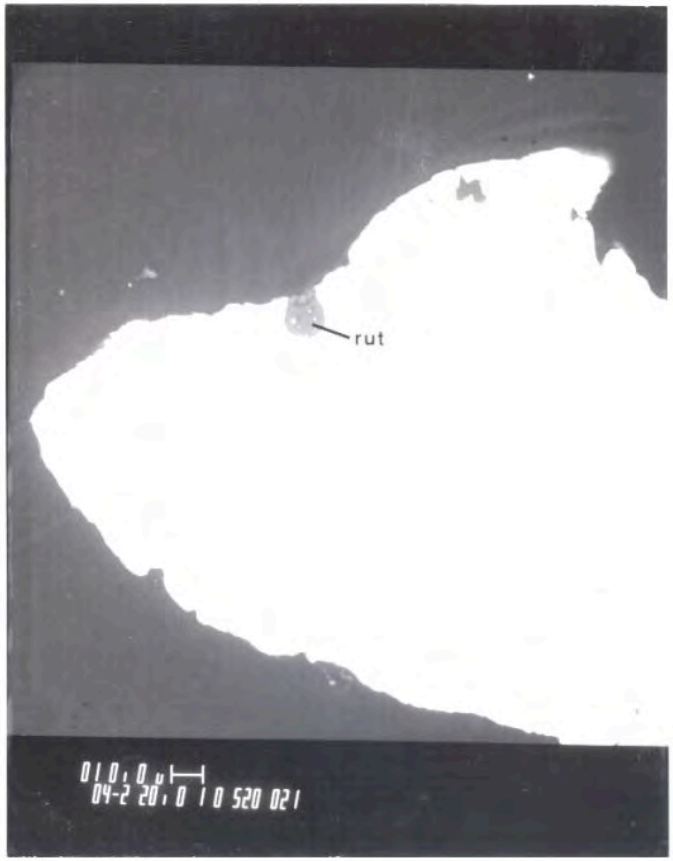

3b)

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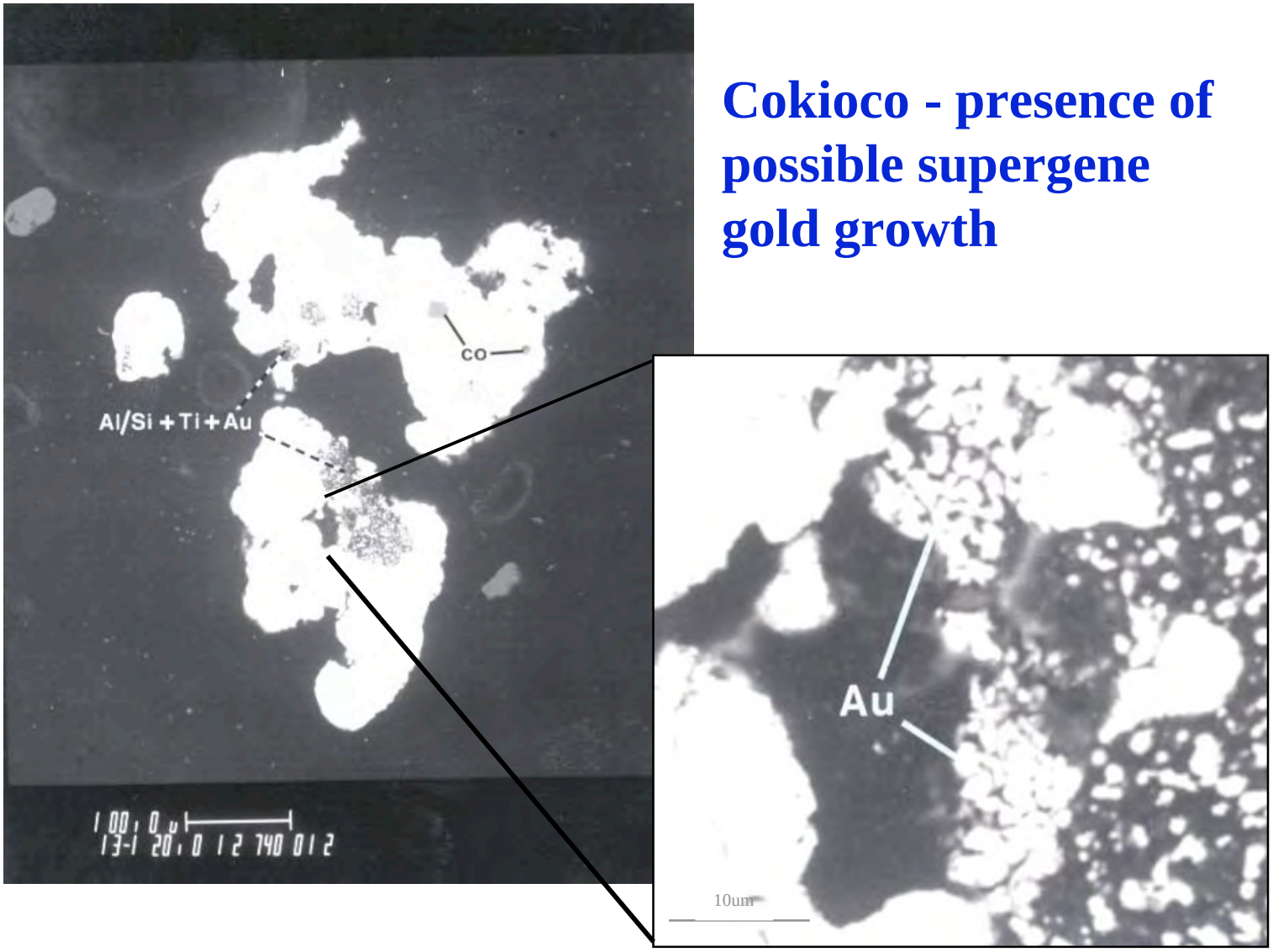
Supergene gold



Cokioco - presence of possible supergene gold growth

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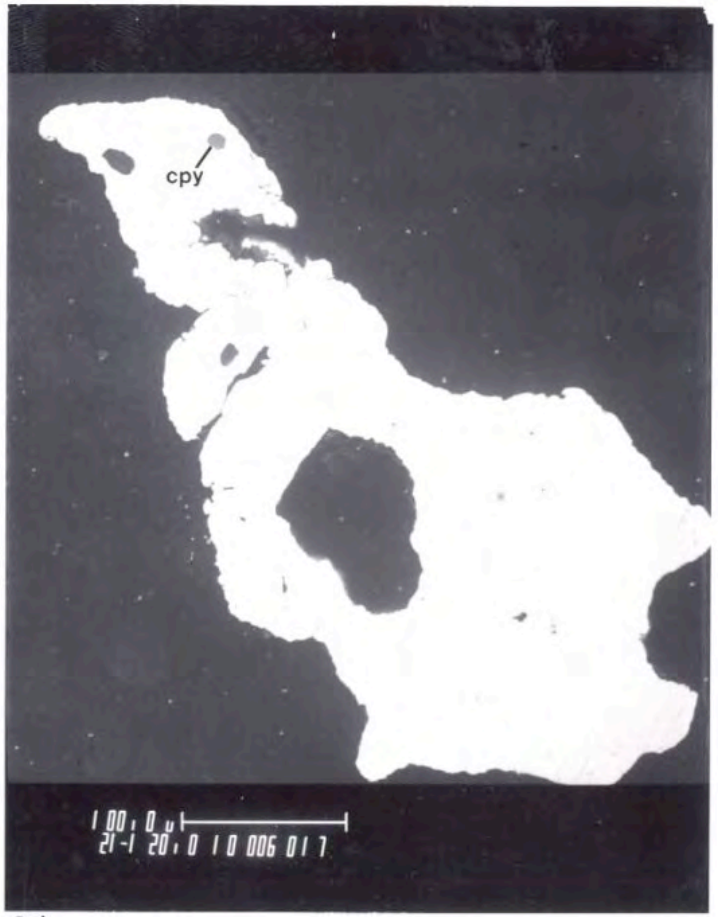
Inclusions

Wayamaga - presence of unstable primary inclusions and gangue (e.g. Chalcopyrite, Ankerite and Sericite)



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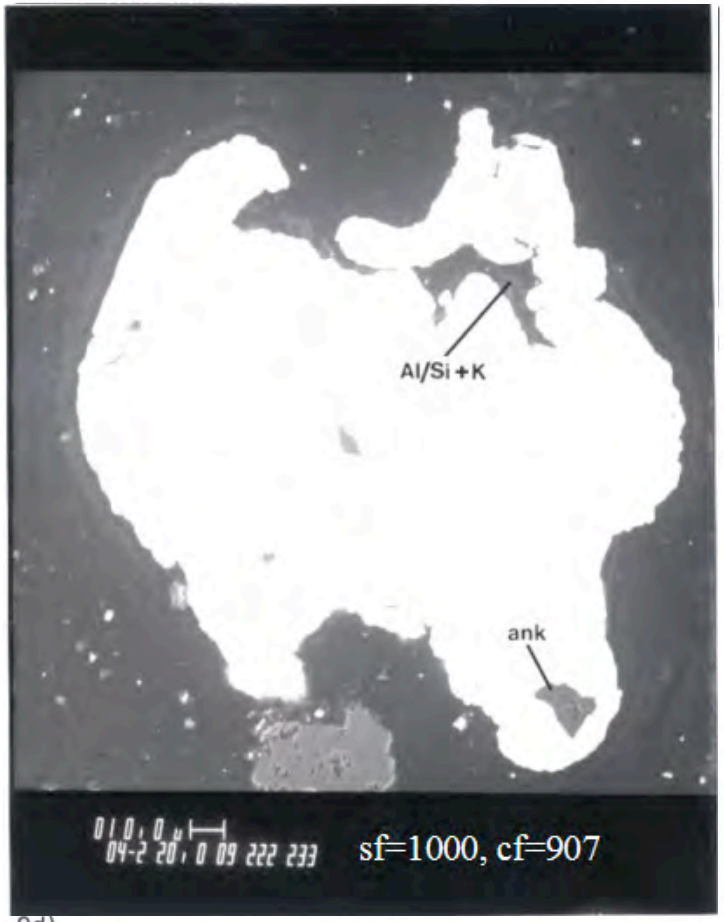

9d)

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Results of Detailed Gold Grain Study

Cokioco vs. Wayamaga

	Cokioco	Wayamaga
Reshaping	Complete	Partial
Grain Size	125-300 um	50-150 um
Leaching of Ag	Complete	Thin or absent
Inclusions	Stable	Unstable

Conclusion #1 – IM's can indicate proximity to lode sources

Conclusion #2 – Canadians can be useful!

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Indicator mineral methods in precious metal exploration

Summary

- **Use of gold grain morphology, abundance, chemistry and other characteristics can be an effective exploration tool**

  But….it must be used with a thorough understanding of the landscape evolution and surficial processes

- **Define the problem first – then test in other environments**

- **Use of other indicator minerals and mineral chemistry may provide additional tools for enhancing the effectiveness of this method for precious metal exploration**

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