IGES 2005

Geochemical Dispersion In the Lateritic Regolith of the Chapada Cu-Mo-Au Deposit, Central Brazil

Chris Benn BHP Billiton

Claudio Porto Federal University of Rio de Janeiro

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Aims

This talk will be about determining the effectiveness of various sample media and extraction techniques for base metal exploration in lateritised terrains of Central Brazil from regional to project scales.

This work is part of an ongoing project looking at processes of regolith development in Brazil that is supervised by Dr Claudio Porto at the Federal University of Rio de Janeiro.

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Background on Regolith Evolution in Central Brazil:

Two main periods of lateritization:

Extensive laterite surfaces with deeply weathered profiles (100m) in the early Tertiary. Remnant surfaces form high plateaus.

A younger one related to the Velhas geomorphological

cycle of Upper Tertiary to Pleistocene age

– (i.e no strong arid overprint)

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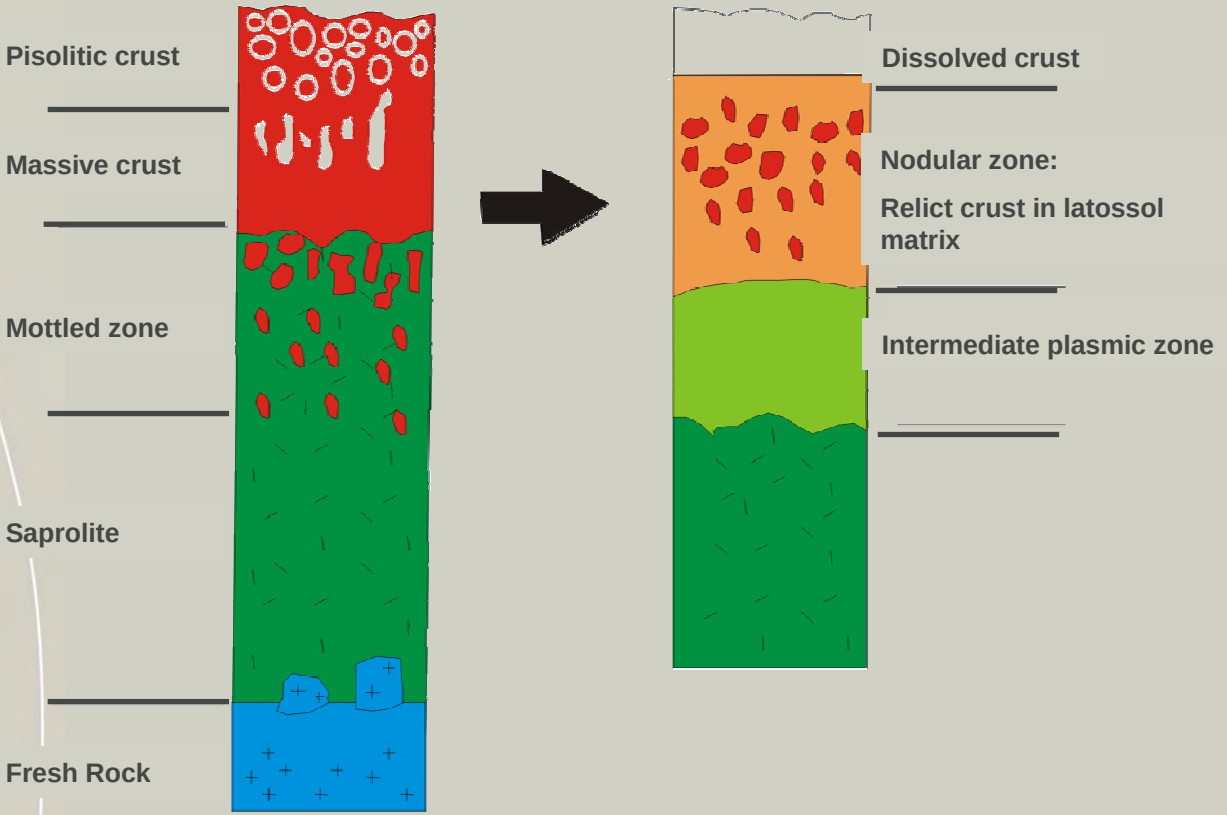
Profile Formation & Transformation– Central Brazil

Profile formation under seasonal regime:
duricrust profile

Profile transformation under humid regime:
red gravelly latosol profile



Central Brazil lateritic profiles formed in the past have been modified under the influence of a predominantly humid regime - Promotes physical and chemical degradation of laterites resulting in the development of latosols.

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The Situation with Base Metal Exploration in Laterite Terrain

Most studies concentrate on gossans but these are rarely reported in tropical humid terrains or where lateritic residuum dominates the landscape.

Possible causes:

- Laterite development obliterate gossan
- Gossan development inhibited under humid conditions

Studies show general tendency for base metal depletion upwards in lateritic profile

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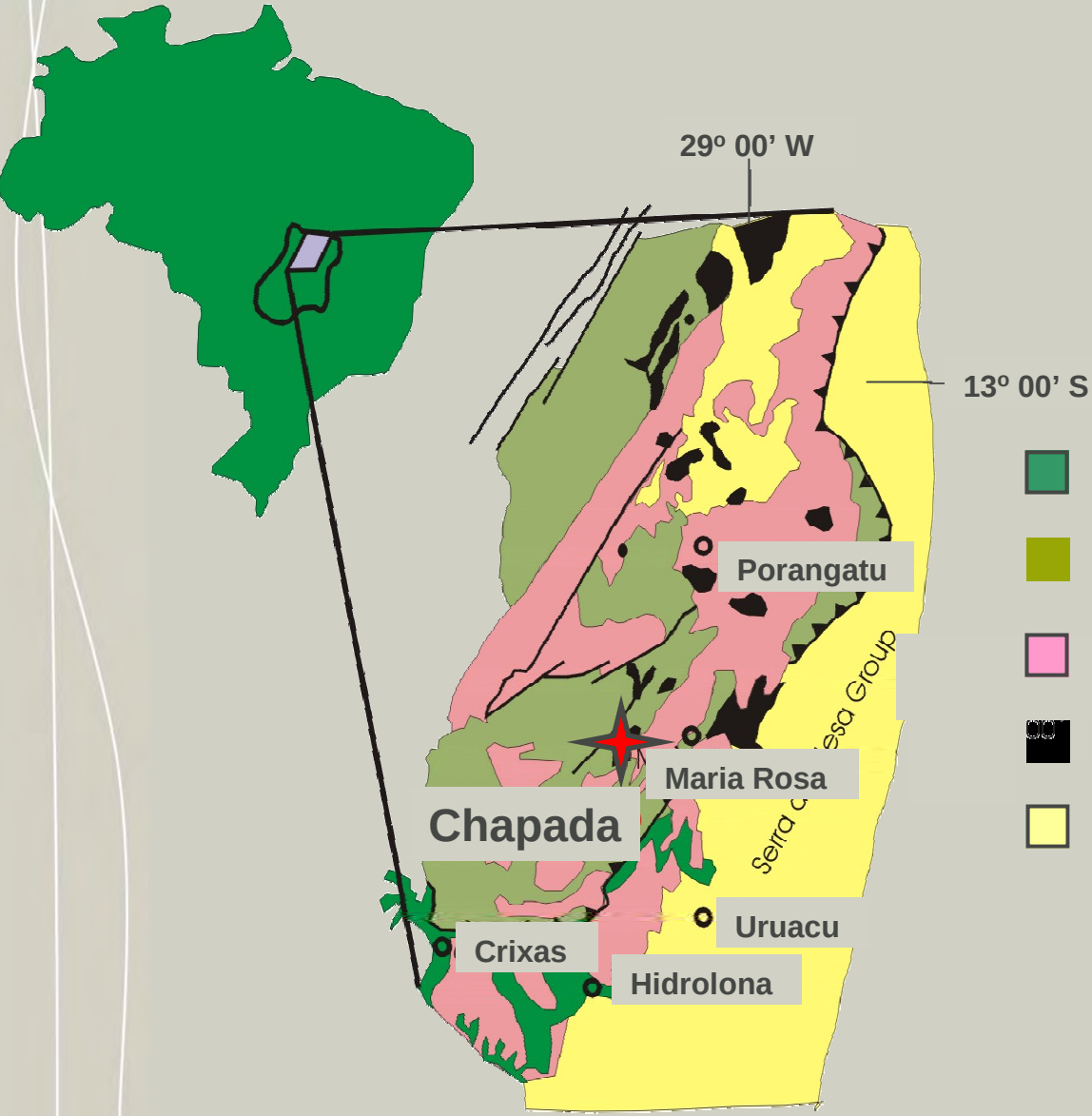
Chapada Cu-Mo-Au Deposit, Goias State Orientation Study



- Greenstone belts
- Volcano-sedimentary sequeces
- Orthogneiss
- Post orogenic granites
- Serra da Mesa Group (Middle Proterozoic)

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Chapada Cu-Mo-Au Deposit

- 155 mt @ 0.4% Cu, 0.01 %Mo, 0.4 g/t Au
- Hosted in biotite, muscovite - schists and amphibolite associated with the Late Proterozoic Mara Rosa volcano-sedimentary sequence
- Principal ore mineralogy is chalcopyrite
- Elements associated with primary mineralization are

Cu, Mo, Au, Pb, Sr

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Chapada Cu-Mo-Au Deposit

Dominated by seasonal humid regime

(similar to savannah type climate)

Annual precipitation – 1800 mm/yr

Covered by 20 m deep lateritic regolith:

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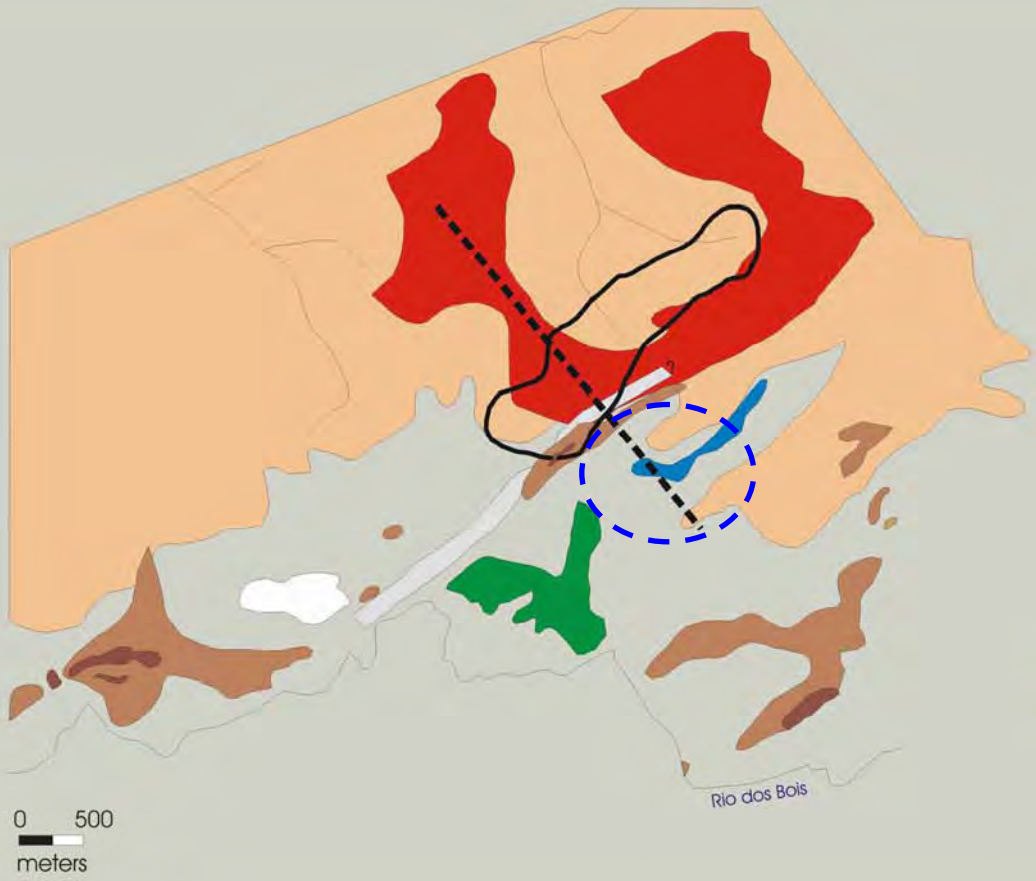
Regolith Map – Chapada



Mineralized area

Orientation line

Domain where crust is close to surface, covered by less than 1 m thick latosol

Domain where crust is more deeply buried beneath thick latosol with only lag at the surface.

Bedrock

- Porphyritic Diorite
- Amphibolite
- Biotite Schist
- Qz Ser Ky
- Muscovite Schist
- Mylonite

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Surface sampling - Lag

Common in relict regimes

and is easy to collect

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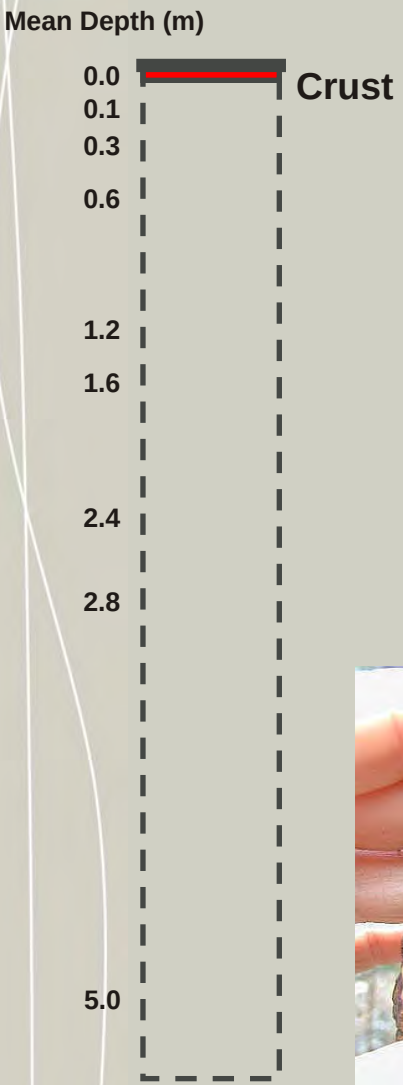
Crust



Crust: scattered blocks about 1 m. May also occur as slabs paving the ground for several meters. Crust shows pisolitic structure, hard with metallic concretions amongst kaolinitic and ferruginous patches.

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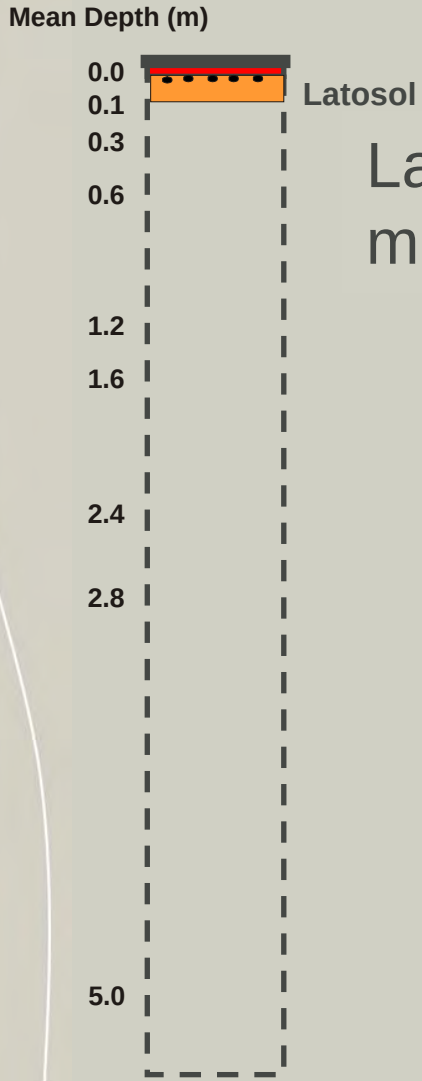
Latosol Humic



Latosol humic: clay rich impregnated with organic matter containing disseminated lateritic fragments

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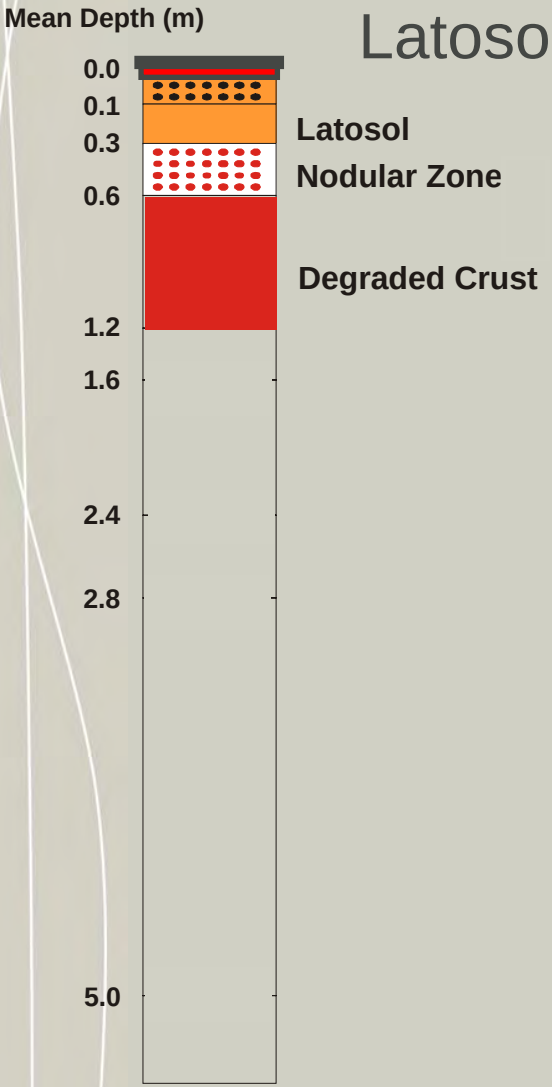
Latosol + Nodular Zone + Degraded Crust



Latosol red clay rich soil containing lateritic fragments

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Mottled Zone

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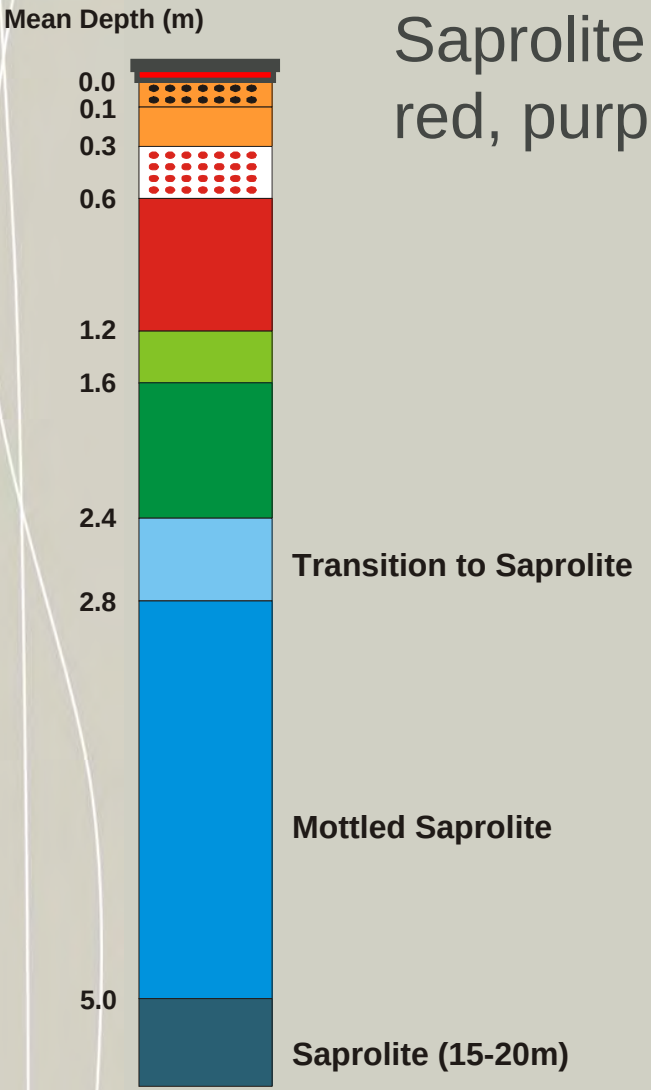
Saprolite



Saprolite – friable and clay rich. Stained in orange, red, purple colors. Relict textures.

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Sampling

- 4 Pits plus 20 auger holes along 1.5 km long traverse sampled down to the saprolite - nearly 150 regolith samples

- Surface samples along 1.5 km long traverse plus regional background samples:

Sample type	Traverse	Background
Lag	23	9
Crust	15	8
Latosol humic	31	9
Latosol	30	9
Saprolite	15	-

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Analytical Techniques

- Crust, Saprolite, Lag: 4 acid , ICP AES, Au FA/AA

- Latosol humic: <80#, Na Pyrophosphate & aqua regia,

  ICP MS, AES

- Latosol: <80#, Proprietary extractant & aqua regia, ICP MS, AES

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Lag – investigation of different types

Buckshot (grey, metallic) (B)

Laterite fragments (L)

Magnetic (M)

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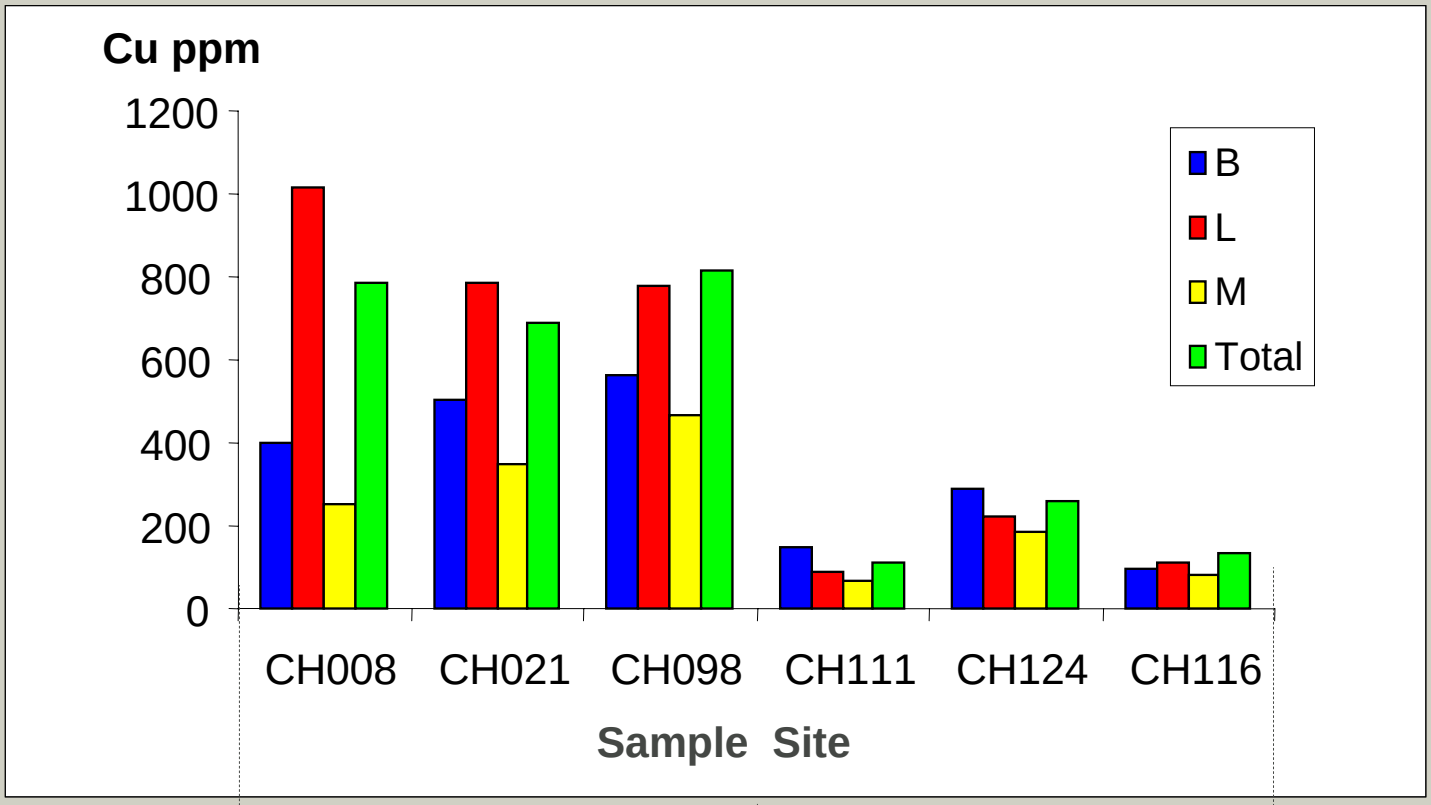
Cu - lag, different types



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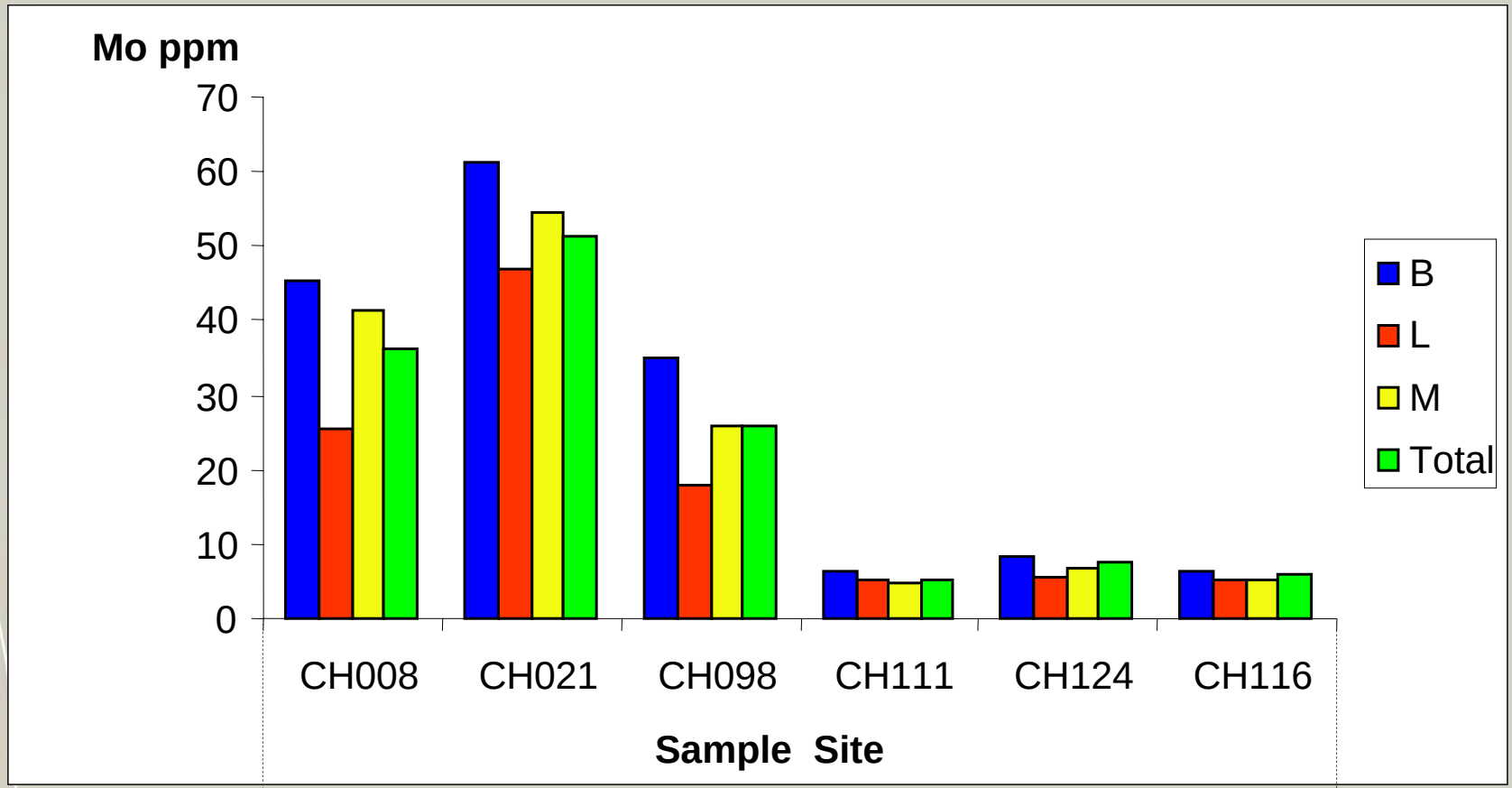
Mo - lag, different types



orebody

background samples

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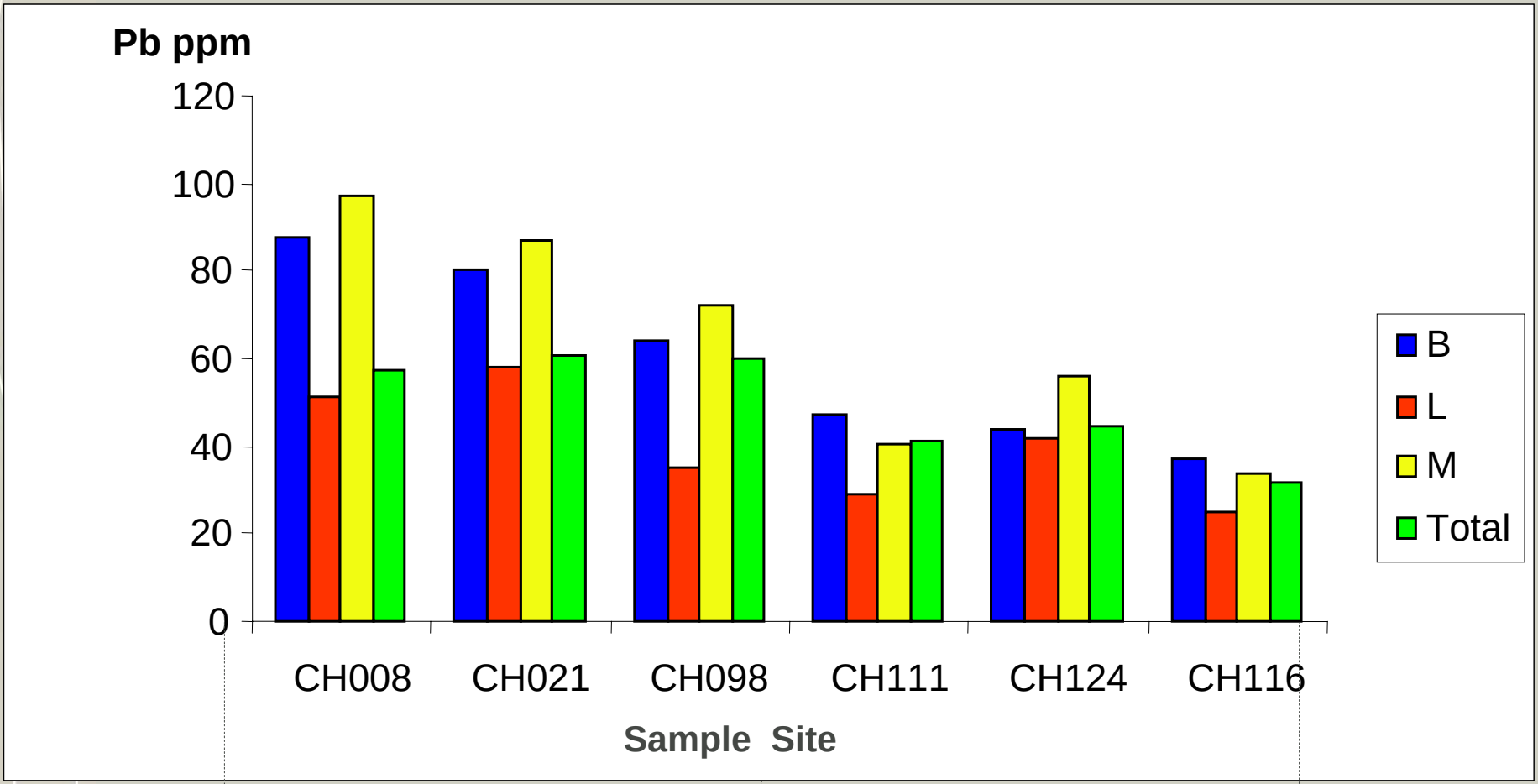
Pb - lag, different types



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background samples

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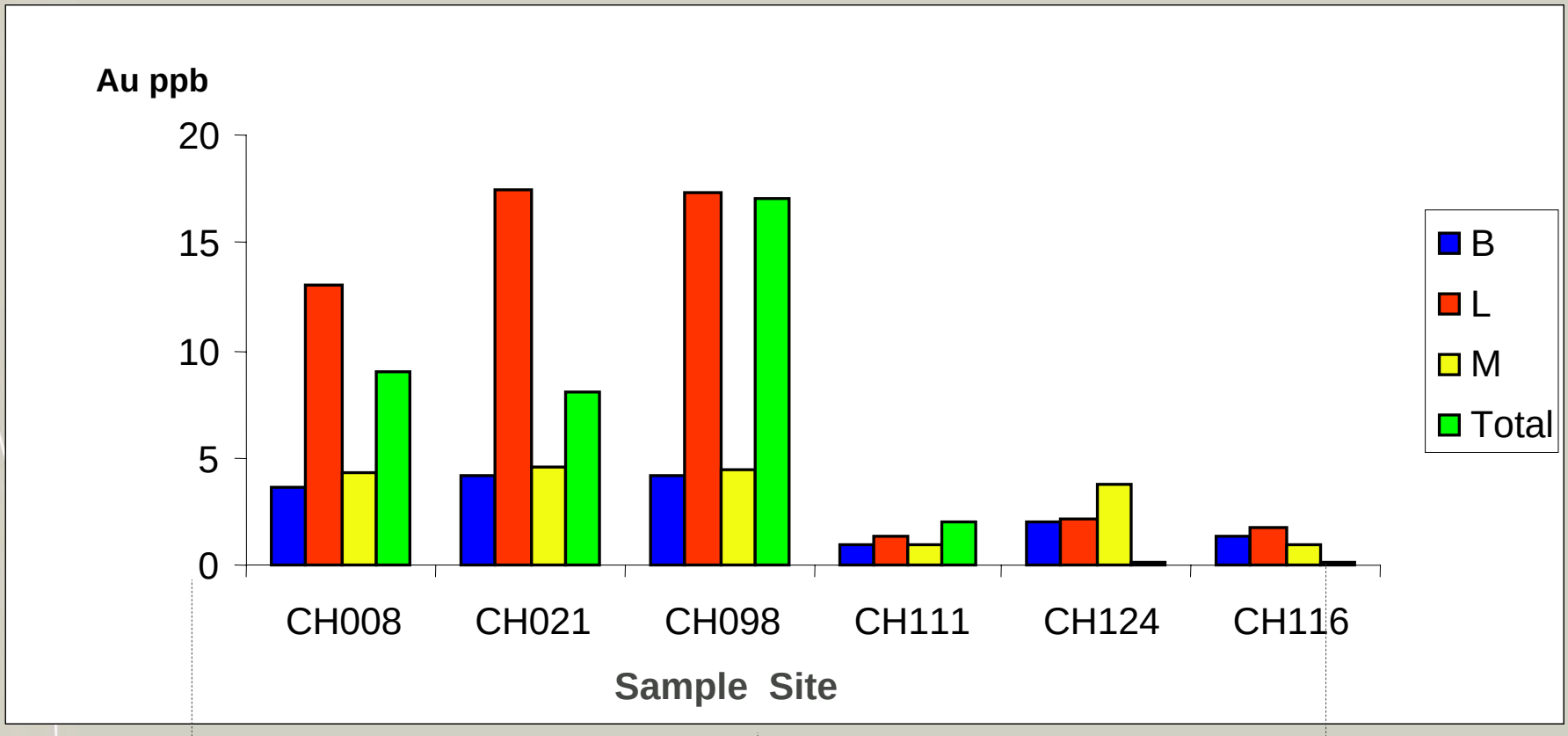
Au - lag, different types



orebody

background samples

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Summary - Lag

Within this lag fraction the lateritic fragments are richest in Cu, Au

The buckshot or magnetic lag fractions are richest for

Mo, Pb.

A total lag sample is acceptable.

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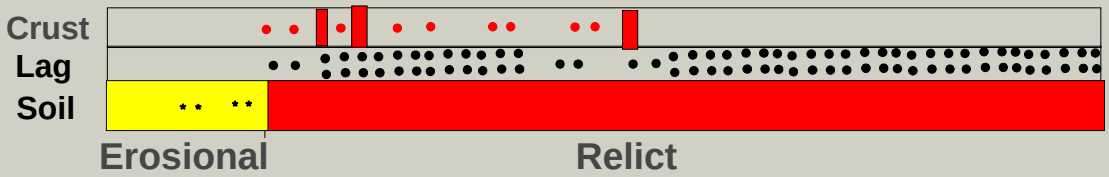
Legend

Abbreviations for slides

L	Lag (total sample)
C	Crust
LH	Latosol (humic)
LS-P	Latosol by proprietary extractant
LS-AQ	Latosol by aqua regia
S	Saprolite



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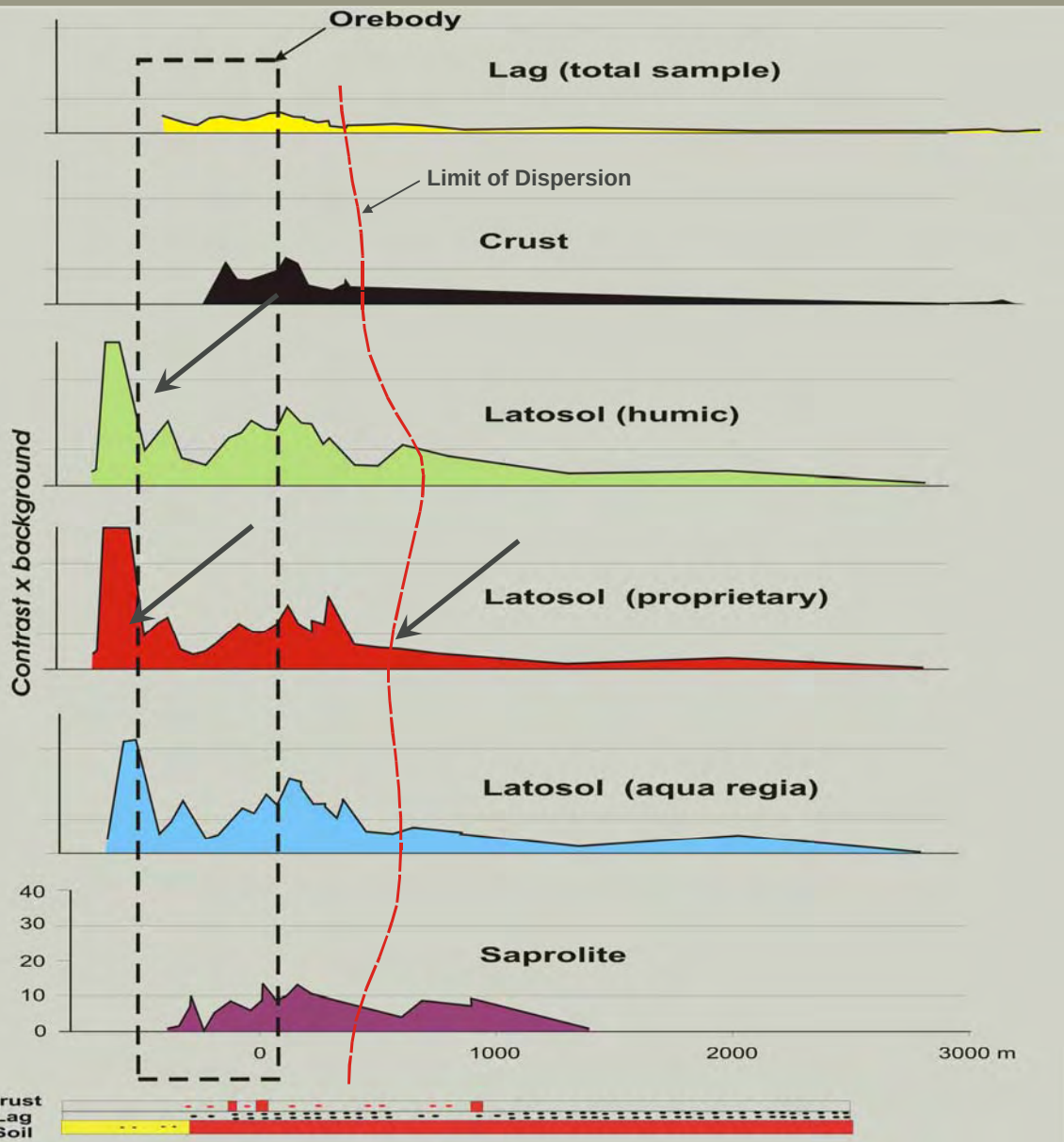
Lateral Dispersion - Cu



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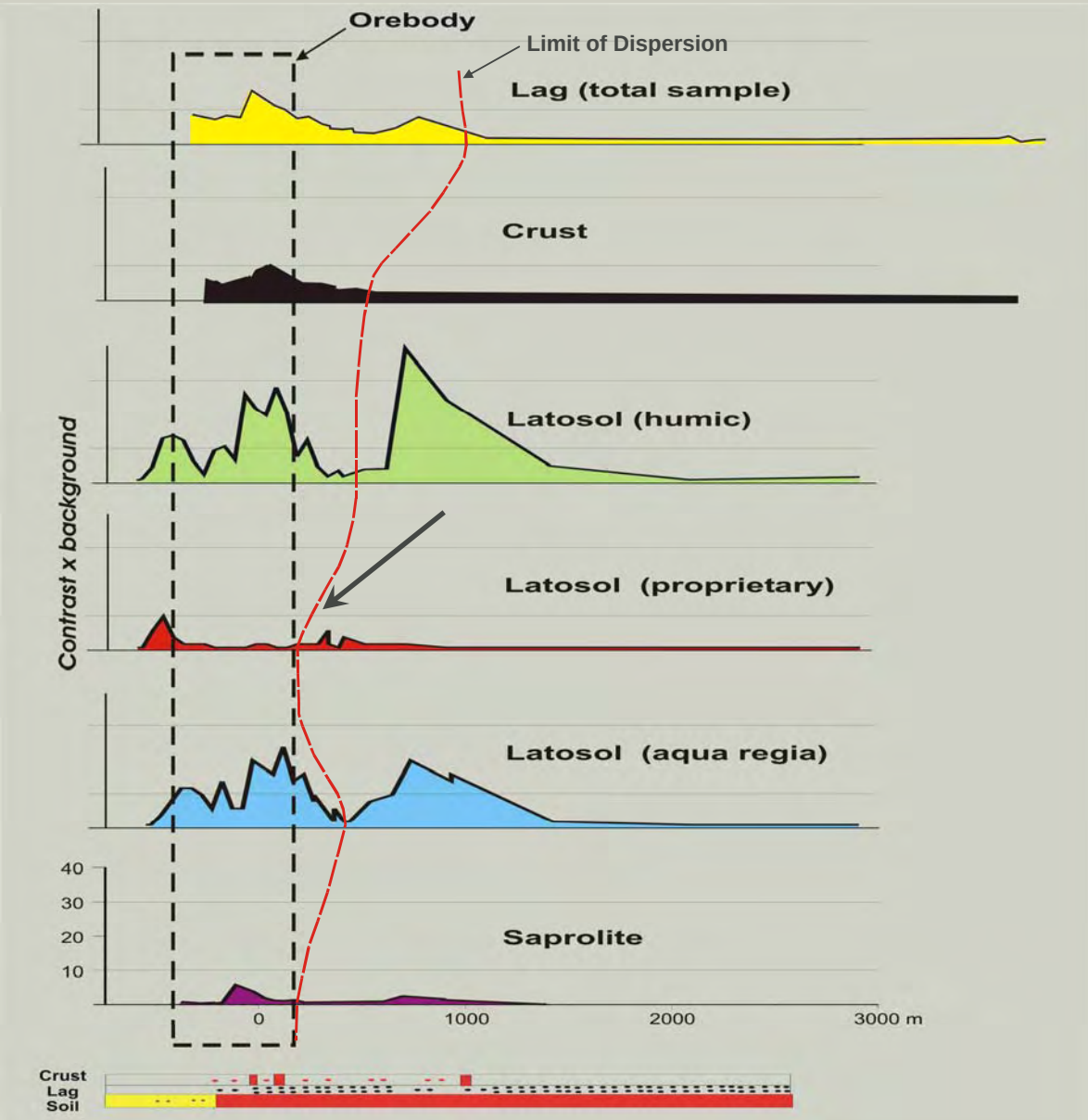
Lateral Dispersion - Mo



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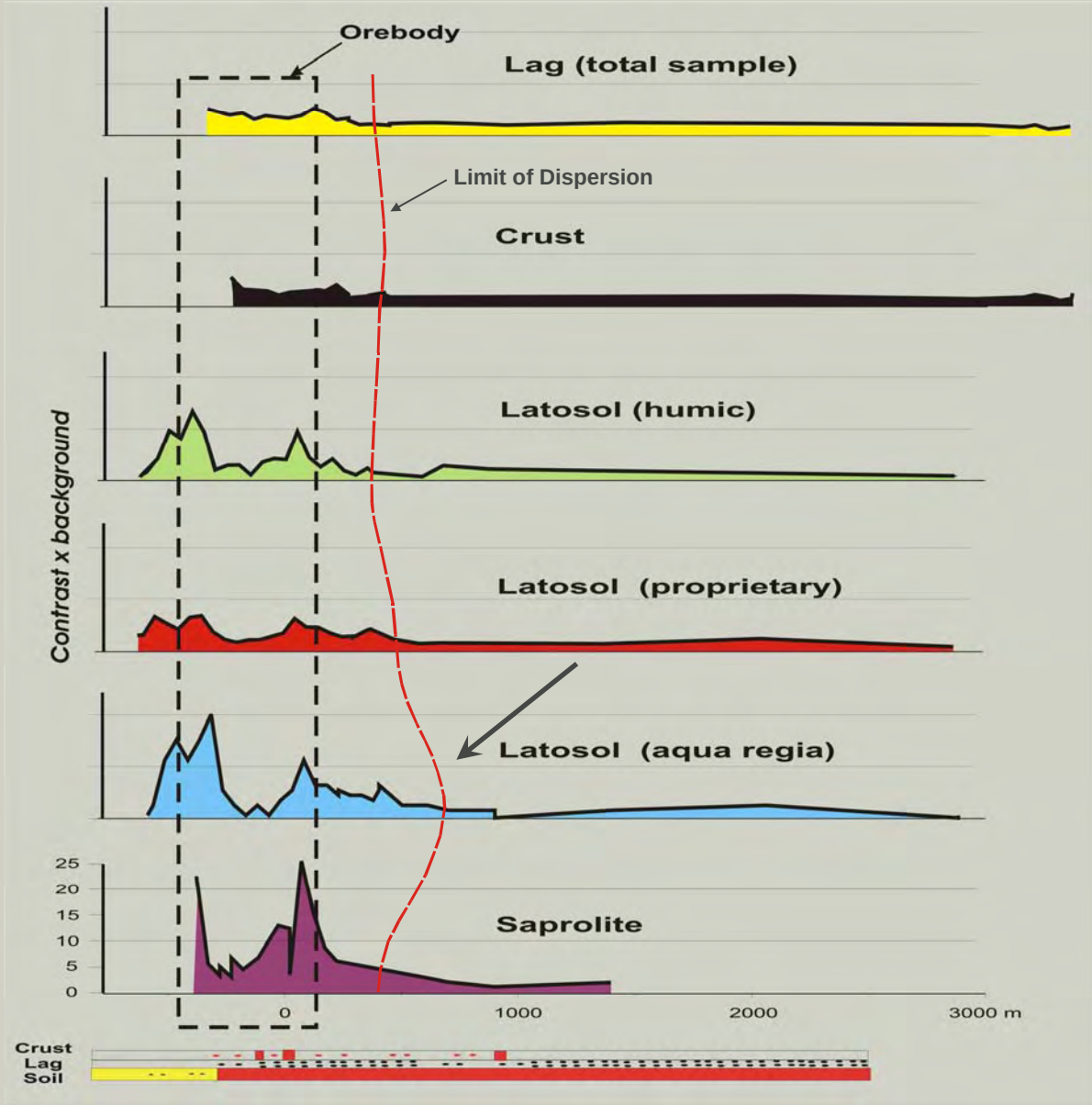
Lateral Dispersion - Pb



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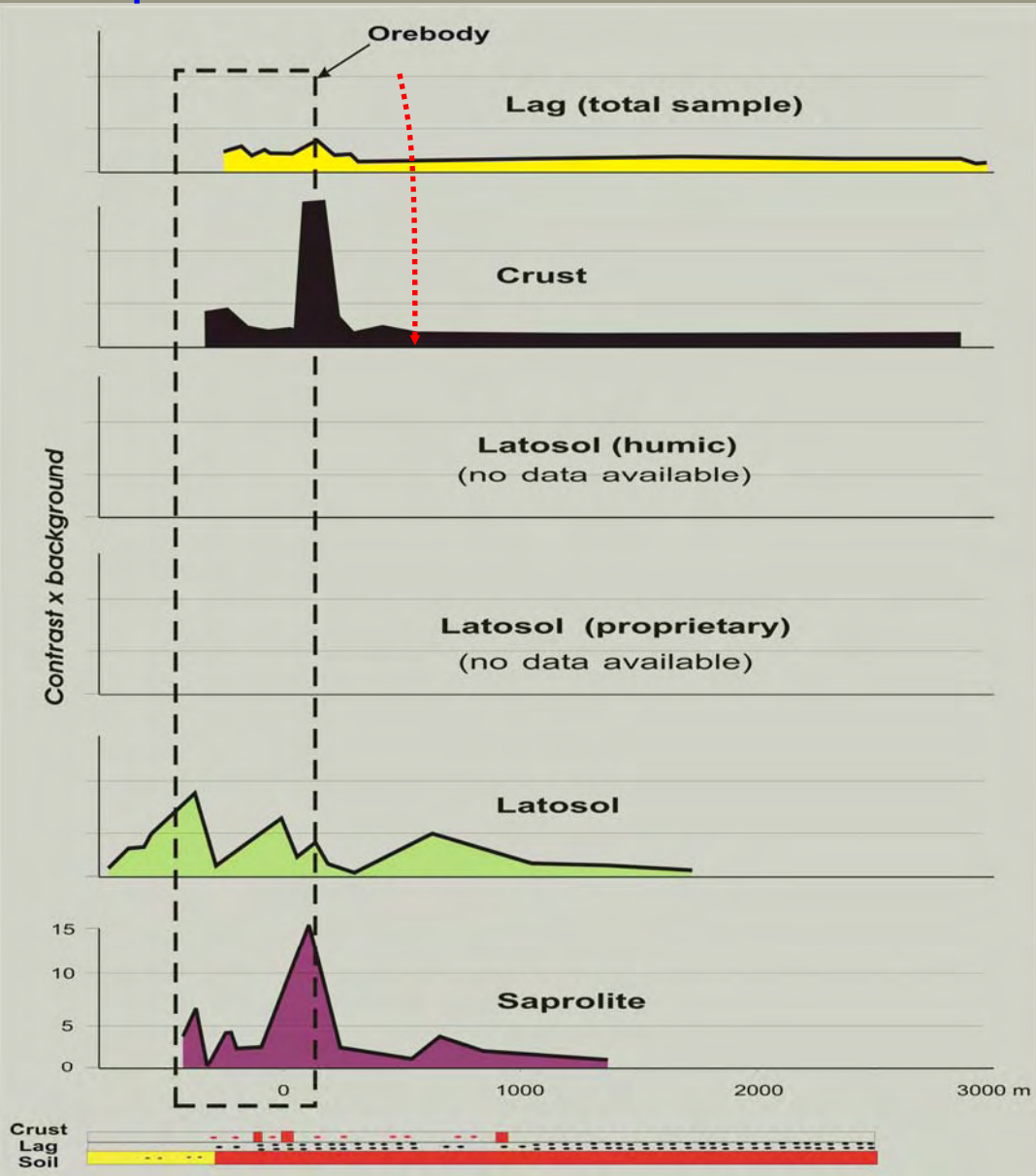
Lateral Dispersion - Au



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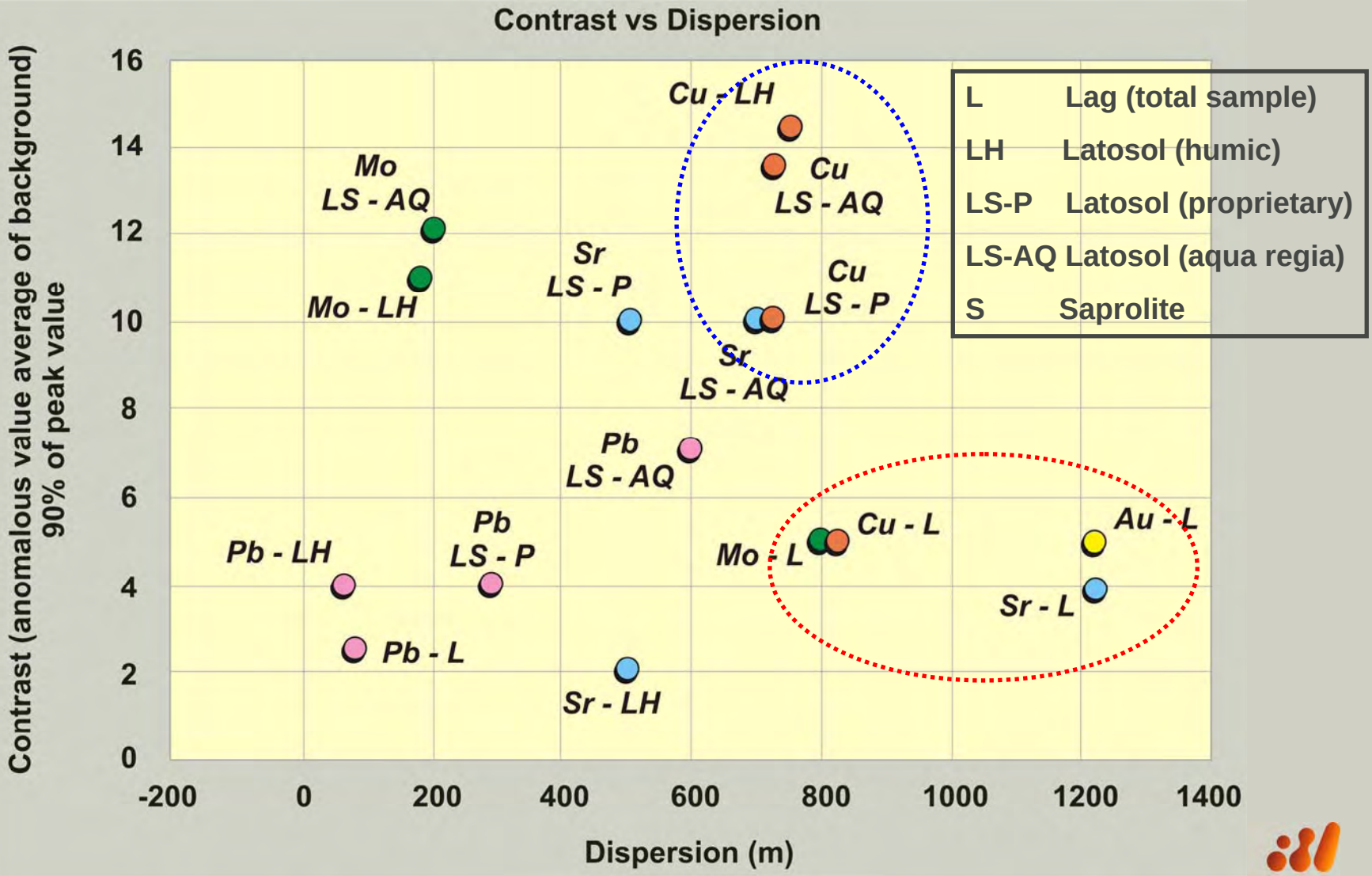
Contrast vs dispersion - Summary



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Practical Outcomes For Mineral Exploration

- Considering important metals associated with the primary mineralization elements: Cu, Mo, Au, Sr, Pb

- Surface crust can be an effective sampling medium but is not always present. Lag is more widespread

- Within this lag fraction the lateritic fragments are richest in Cu, Au while the buckshot or magnetic lag fractions are richest for Mo, Pb, Bi . However a total lag sample is acceptable.

- Crust and lag can show dispersion of the order of 1 km and should be considered for regional surveys.

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Summary and Practical Outcomes (con)

- Despite strong base metal leaching upwards in the regolith the geochemical signal in the latosol is of a high enough contrast to indicate mineralization

- Proprietary and selective extractants are not effective at improving the contrast and offer no advantage over the stronger extractions

- Background levels of trace elements in latosol will vary according to thickness and development of latosol. Latosol has a lower response when developed in a relict regime and a higher response in an erosional regime (over saprolite).

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Sampling Strategy - In a Perfect World

Regional Scale

Crust / lag - 4 acid

Regional/Local

Latosol –Aqua Regia

At all scales – record development of profile.

At local scale – regolith map is essential

Use power auger if necessary - presence of crust at surface not necessarily an impediment to auger drilling since soft crust is penetrable

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THANK YOU

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