3D Basin Architecture & Mineral Systems in the Mt Isa Western Succession: summary & implications for mineral exploration

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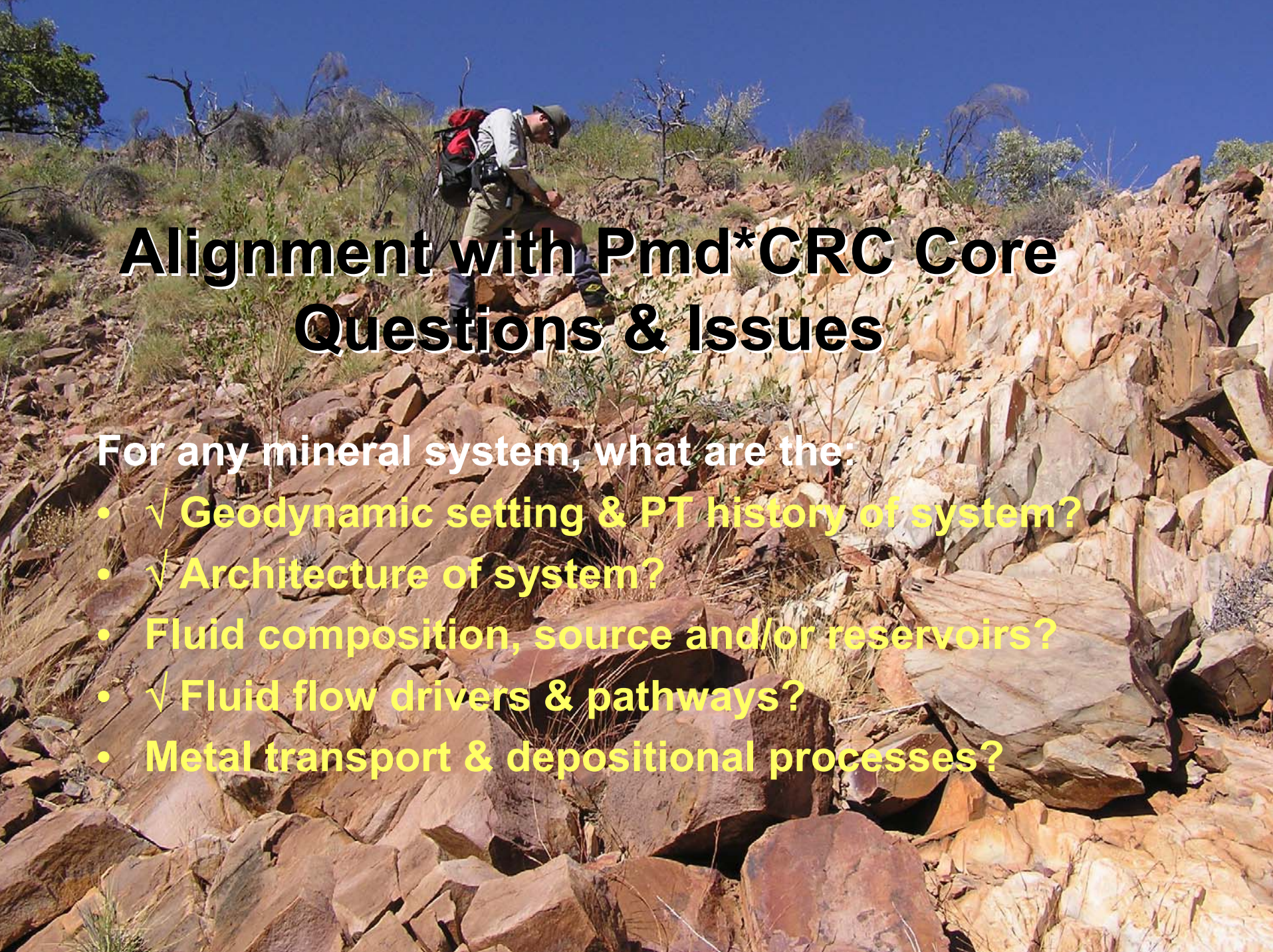

Alignment with Pmd*CRC Core Questions & Issues

For any mineral system, what are the:

- √ Geodynamic setting & PT history of system?
- √ Architecture of system?
- Fluid composition, source and/or reservoirs?
- √ Fluid flow drivers & pathways?
- Metal transport & depositional processes?

Geodynamic Setting & P-T history

Making a difference:

1. Detailed chronostratigraphic framework now available for entire Western Succession (1800-1575 Ma)
2. Depositional, structural & magmatic histories integrated into single coherent and internally consistent geodynamic framework
3. Recognition that magmatic intrusion (Sybella "event") is intimately linked to basin evolution and governed by same extensional processes that gave rise to growth faulting & sedimentation

Geodynamic Setting & P-T history

Making a difference continued:

4) Basin evolved from rift → passive margin over 160 Ma period before inversion at ~1540 Ma (Shady Bore Qzite time)
5) Initial basin [illegible] of NW-SE shortening & [illegible]lting
6) Basin in[illegible]90 Ma Isan Orogeny
7) Upper Mc[illegible]ost-Shady Bore Qzite) deposited u[illegible]nt tectonic regime (foreland basin)

Paradigm shift

Architecture of system

1) Original basin shape & architecture result of two temporally distinct but interconnected extensional events (from 1800 -1740 Ma; 1730 – 1640 Ma)
2) Strong basement control on orientation of growth faults at Myally (NNW-SSE) and Prize (E-W) time
3) Present-day structural geometry result of interference between three post-depositional tectonic events (D1-D3)
4) Significant but indeterminate component of structural repetition due to D2 and D3 thrust faulting

Fluid flow drivers & pathways

Inferences & speculation:

1) No single period of tectonically-driven fluid flow
2) Early convective fluid flow related to growth faulting & above-average heat flow during two periods of rifting & extension. Potential for BHT Pb-Zn deposits (cf. Cannington) in carbonaceous rocks of Prize (1670-1690 Ma) and younger age (Isa/McNamara Groups); Irish-style Pb-Zn deposits in Quilalar Fm.
3) Expulsion of *basinal brines* during D1 southeast-directed thrust faulting in response to tectonic loading and/or newly created topographic head. Potential for ≤ 1640 Ma, HYC, MVT or replacement-style Pb-Zn deposits in carbonate-dominated sequences

Fluid flow drivers & pathways

Inferences & speculation continued:

1) Expulsion of oxidised, metal-bearing (Cu, Mn) *metamorphic* fluids following D2 and D3 breaching of seals above rock packages tectonically buried and heated to over 200°C during earlier D1 crustal shortening. **Potential for Cu mineralisation in reduced rocks adjacent to reactivated growth faults or faults of D2/D3 age**

5) Fluid conduits & hydrothermal footprints mappable at regional scale through remote sensing