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Economic Geology (111201491)

Part5: Ore deposits in a global tectonic context

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Patterns In The Distribution Of Mineral Deposits

Mineralization are not randomly distributed, either in time or in space, and that broad patterns exist when relating deposit types to crustal evolution and global tectonic setting.

hydrothermal and volcano-sedimentary base- deposits formed mainly in late Archean and Phanerozoic times, whereas **chemical-sedimentary and ultra-mafic deposits** reflect concentration mechanisms that took place in the mid-Proterozoic.

Plate Tectonics And Ore Deposits

A. Extensional settings

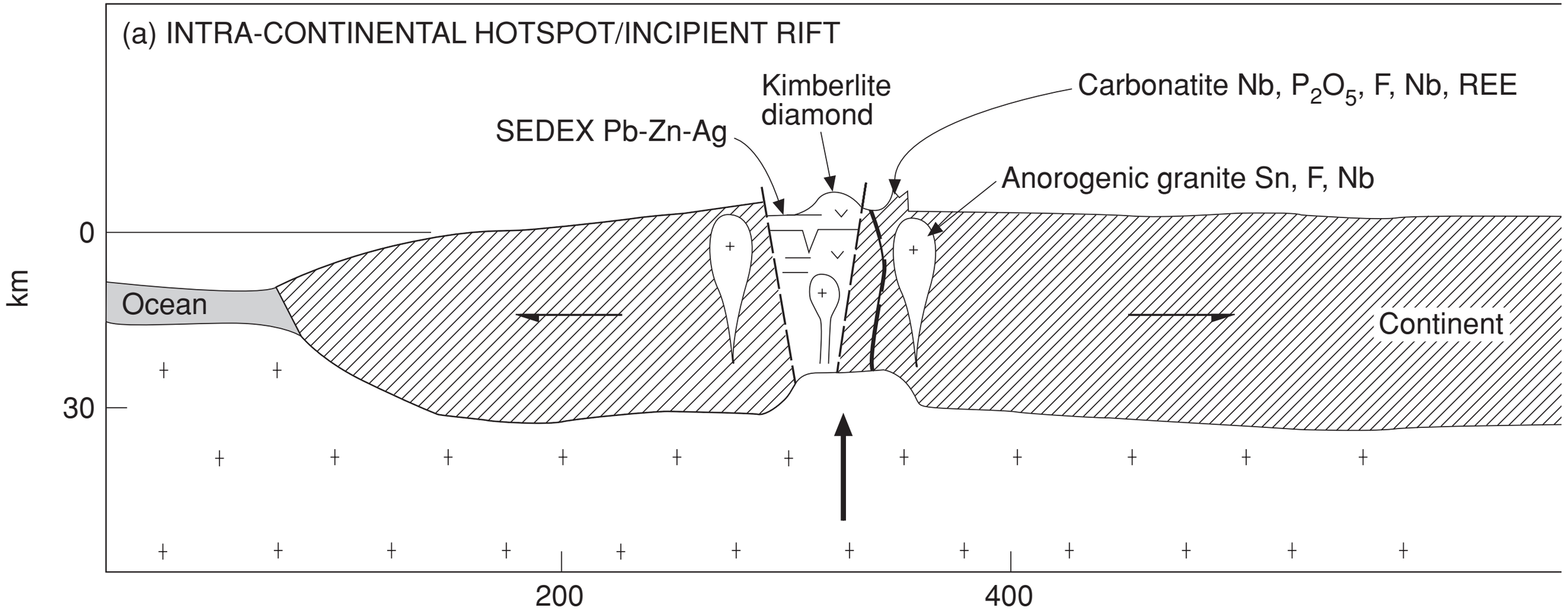
Incipient **rifting** of stable continental crust, where thinning and extension may be related to hotspot activity.

Magmatism is often localized as alkaline or ultr–apotassic in character.

ore deposit types formed in this setting includes:

- Granites such as those of the Bushveld Complex (Cr, Sn, W, Mo, Cu, F, etc.),
- pyroxenite–carbonatite intrusions (Cu–Fe–P–U–REE etc.), and
- kimberlites (diamonds)

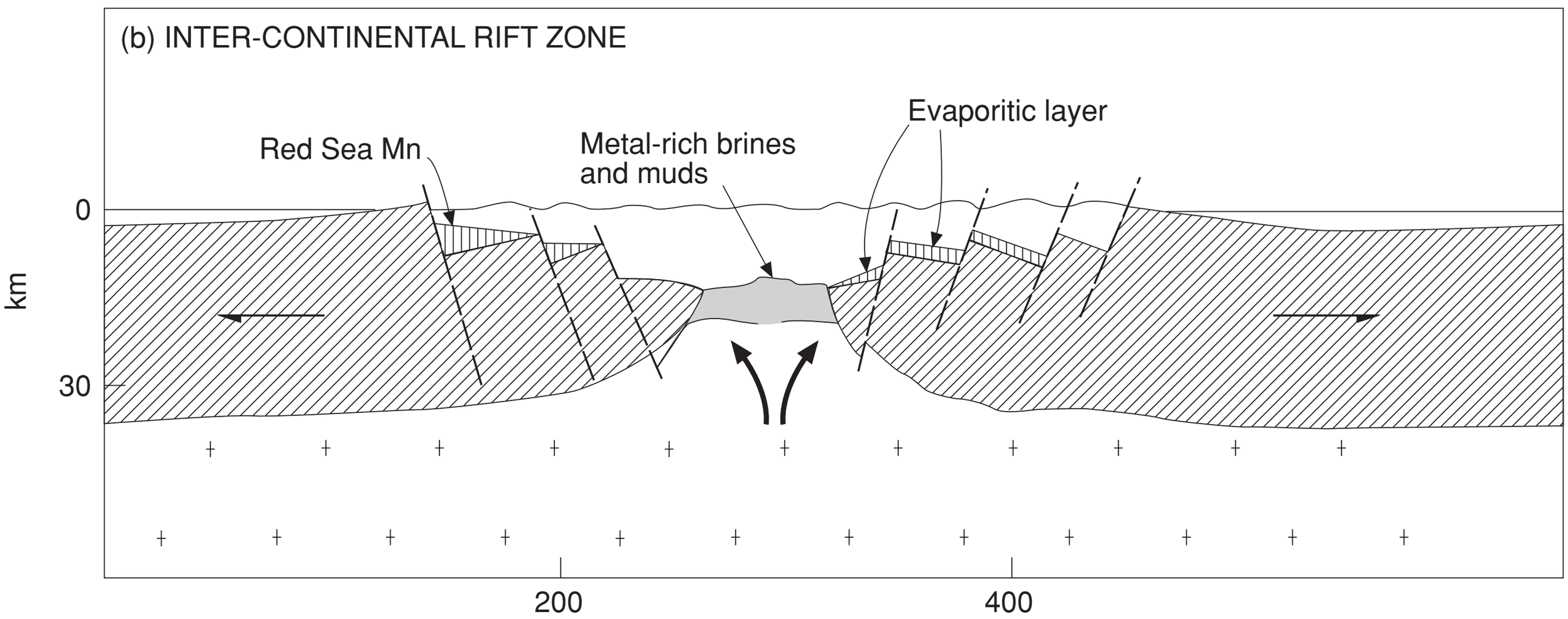
EXTENSIONAL SETTINGS



- SEDEX-type (Sedimentary exhalative deposits) Pb -Zn-Ba-Ag deposits.
- As continental rifting extends to the point that incipient **oceans begin to open** (such as the Red Sea;), basaltic volcanism marks the site of a mid- ocean ridge.

Such settings also provide the environments for:

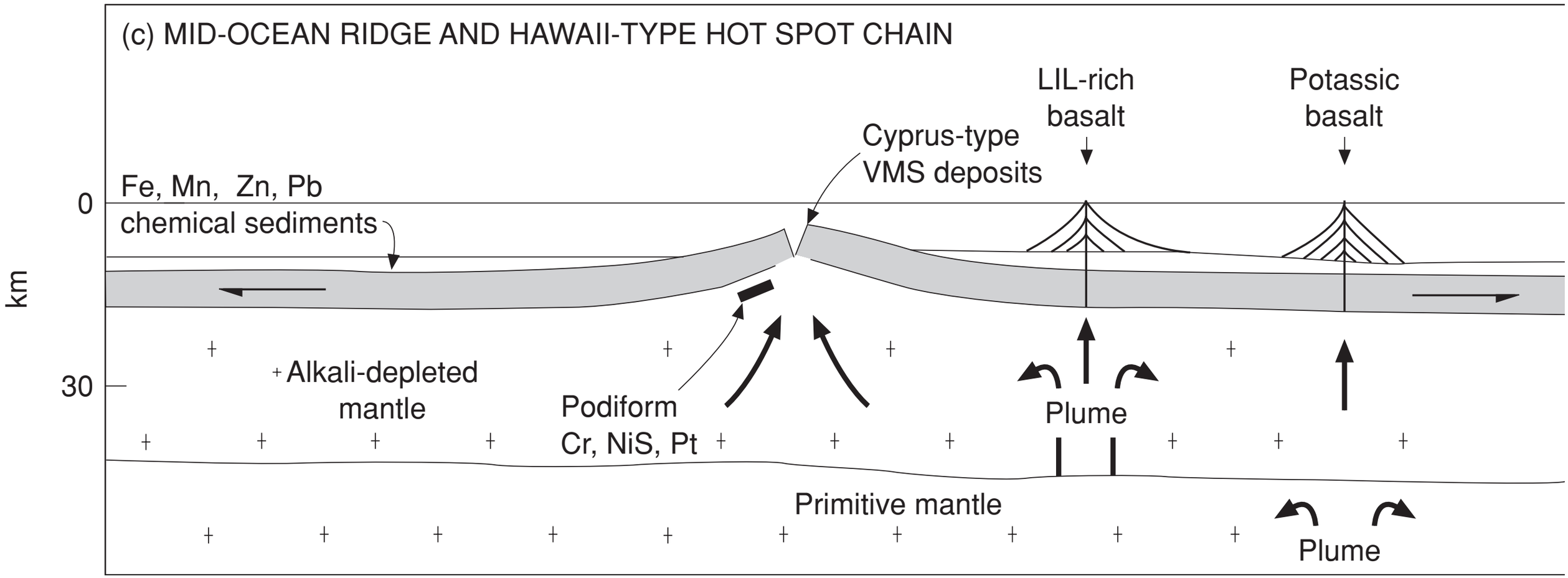
- Hydrothermal activity and plentiful VMS deposit formation ((Volcanogenic massive sulfide).
- Chemical sedimentation and precipitation of banded iron-formations and manganiferous sediments.
- Organic accumulations that on catagenesis give rise to oil deposits.


(b) INTER-CONTINENTAL RIFT ZONE
Red Sea Mn
Metal-rich brines
and muds
Evaporitic layer
0
km
30
200
400

- Carbonate sedimentation provides the rocks which host **MVT deposits** (Mississippi Valley-Type Lead-Zinc Ores)

- Exhalative activity at these sites gives rise to "black-smoker" vents that provide the environments for the fomation of **VMS deposits** (Volcanogenic massive sulfide deposits).

- The basalts which form at mid-ocean ridges also undergo fractional crystallization to form podiform **chromite deposits** as well as Cu-Ni-PGE sulfide.


(c) MID-OCEAN RIDGE AND HAWAII-TYPE HOT SPOT CHAIN
LIL-rich basalt
Potassic basalt
Cyprus-type VMS deposits
Fe, Mn, Zn, Pb chemical sediments
0
km
30
Alkali-depleted mantle
Podiform Cr, NiS, Pt
Plume
Primitive mantle
Plume

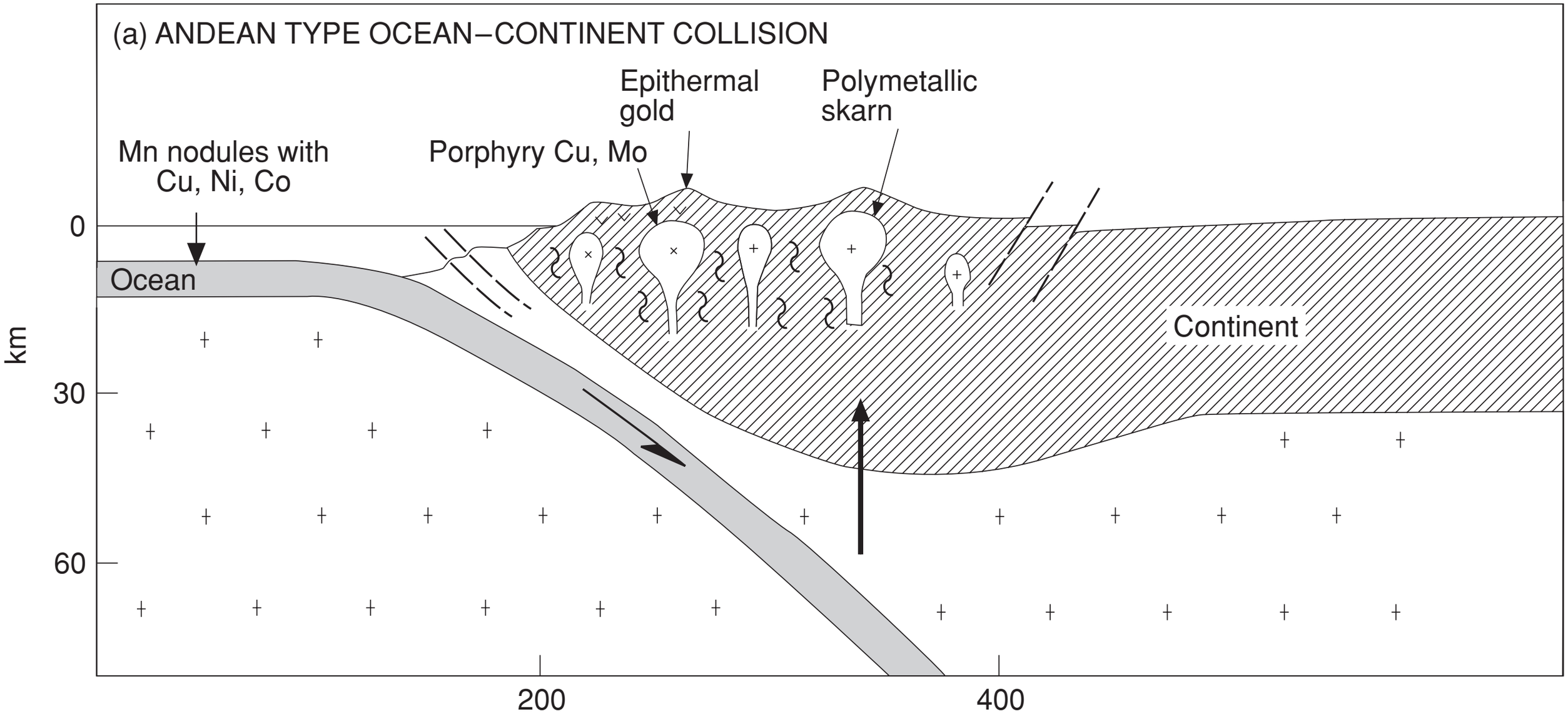
B. Compressional settings

The collisional margins are the sites of the great porphyry Cu-Mo provinces of the world.

Inboard of the arc significant Sn-W granitoid-hosted mineralization also occurs.

The volcanic regions above the porphyry systems are also the sites of hydrothermal precious metal mineralization.

COLLISIONAL SETTINGS



A similar tectonic setting can exist between **two slabs of oceanic crust**, as represented by the island arc environment

Porphyry Cu-Au deposits occasionally occur associated with the <u>early</u> stages of magmatism in these settings,

whereas the <u>later</u>, more evolved calc-alkaline magmatism gives rise to VMS deposits.

200 400

(b) ISLAND ARC AND INTER-ARC BASIN (ocean–ocean collision)

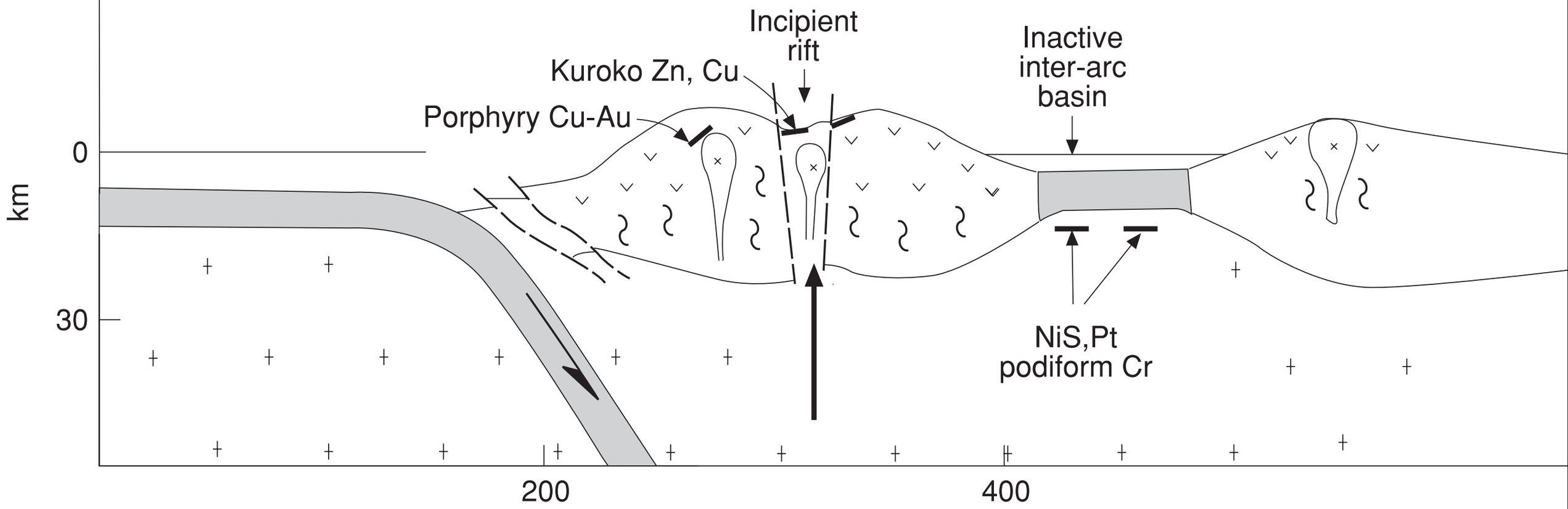


TABLE 21.2 **Occurrences and Uses of Nonmetallic Minerals**

Mineral	Uses	Geological Occurrences
Apatite	Phosphorus fertilizers	Sedimentary deposits
Asbestos (chrysotile)	Incombustible fibers	Metamorphic alteration
Calcite	Aggregate; steelmaking; soil conditioning; chemicals; cement; building stone	Sedimentary deposits
Clay minerals (kaolinite)	Ceramics; china	Residual product of weathering
Corundum	Gemstones; abrasives	Metamorphic deposits
Diamond	Gemstones; abrasives	Kimberlite pipes; placers
Fluorite	Steelmaking; aluminum refining; glass; chemicals	Hydrothermal deposits
Garnet	Abrasives; gemstones	Metamorphic deposits
Graphite	Pencil lead; lubricant; refractories	Metamorphic deposits
Gypsum	Plaster of Paris	Evaporite deposits
Halite	Table salt; chemicals; ice control	Evaporite deposits; salt domes
Muscovite	Insulator in electrical applications	Pegmatites
Quartz	Primary ingredient in glass	Igneous intrusions; sedimentary deposits
Sulfur	Chemicals; fertilizer manufacture	Sedimentary deposits; hydrothermal deposits
Sylvite	Potassium fertilizers	Evaporite deposits
Talc	Powder used in paints, cosmetics, etc.	Metamorphic deposits