Powerpoint Presentation
Handout
Geological, Tectonic and Metallogenetic Relations of South China (P603)

Research Team:
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Geological, Tectonic and Metallogenetic Relations in South China (P603)

- Aims of the Project
  - To establish a GIS (ARC/INFO, ArcView and Mapinfo) integrated, comprehensive digital geoscience data set and mineral deposit database for South China focusing on the distribution of ore deposits built on the successful AMIRA project P590A for mineral SE Asia
  - To undertake a tectonic and metallogenetic analysis of the selected mineralised belts in the region, with particular emphasis on geological framework, structural relationships, and regional metal distribution based on the GIS database
  - To develop a geodynamic and metallogenetic model for the evolution and origin of mineralised belts in these regions.
Mineral Deposits

3,300 mineral deposits

Geochronology

1067 Dates
Paleogeographic and Tectonic Development of South China

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School of Earth Sciences, University of Tasmania

Major terranes/blocks (Li et al., 1996)

Tectonic outline map—tectonics stops at China borders
(Wang & Mo, 1995)
Early Precambrian framework of China (Ma & Bai, 1994)

APW paths compiled by Burrett (1987, unpbd. data)

Greater Gondwanaland (Burrett et al., 1986)
South China between Australia and Laurentia = 800 Ma (Li et al., 2002)

Qingling collision belt (Meng & Sheng, 1999)

Geology of Shandong Province
Structural History of South China

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Mineral Deposits in South China I (P603)

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China's Gold Production

Production: 25 t in 1980 to currently 180 t Au
70 major gold deposits
reserves >4500 t Au

- Hei Long Jiang - placer
- North China - greenstone & mesothermal
- East Shandong - mesothermal
- Quingling - Carlin-type & Chuan-shan-dan - mesothermal
- Southern China - Carlin-type Gune-Gun-dan

Regional Geological Setting of China's Gold Districts

- China's gold deposits occur mostly within fold belts along the margins of 3 major orogens:
  - Sino-Korean (S - W Prot.)
  - Taim (M - U Prot.)
  - Yangtze (M - U Prot.)

- Chinese Carlin-type gold deposits occur in two Paleozoic - Mesozoic sedimentary basins along the margins of the Yangtze Craton:
  - N Gold Triangle
  - S Gold Triangle

China's Base Metal Deposits

- Anbes - VHMS (Devonian)
- East Jilin - VHMS (Ordovician)
- East Liaoning (Hongshan) - VHMS (Archean)
- Xiuyu - VHMS (Late Proterozoic)
- Eastern China - VHMS, SEDEX (Devonian-Carboniferous)
  - Porphyry Skarn (Yamashitani)
- West Sichuan - VHMS (Triassic) & MVT (Simian)
- West Yunnan - VHMS & SEDEX (Proterozoic, Paleozoic to Tertiary)

Yunnan Mineral Deposits

(1) Skler deposits
(2) Sill deposits
(3) Skarn deposits
(4) Wuite deposits
(5) MVT deposits

- Newly discovered Dapuliang deposit has 4.2% Cu, 2% Zn, 0.7% Ag, 23.5 g/Tm, and 11 g/gAg

- Presence of thick carbonate sequence and palaeostructural setting suggested potential for Late Proterozoic (Sinian) MVT deposits in Yunnan

- Qalingdi MVT deposit in Sichuan has 24 Mt of 1.8% Zn, 0.8% Pb, and 43 g/gAg
Copper deposits

1. VMS deposits
2. Yanshankai deposits
3. B-M-Cu deposits
4. Porphyry deposits
5. Potential for sedimentary copper deposits: Proterozoic Dongshuang (Sedex) deposits

Sedex Cu is attractive due to: (1) lateral extent (2) copper grades sometime surpass porphyry Cu with desirable metal such as cobalt and silver.

Gold deposits

1. Au-Excess Porphyry (e.g., Xuebaoding)
2. Volcano-breccia deposits (e.g., Jinfu)
3. Mesothermal gold deposits (e.g., Jinchang)
4. P2-Au-Cu-Au deposit
5. Gravitational deposits

Kuzhubao Gold Prospect (KZB)

- Discovered late 1990s by Chinese Geological Team from 20 ppb Au SS anomaly
- Devonian black carbonaceous pyritic mudstone host (D,F)
- Cambrian dolomite lens (E,F)
- Micro-disseminated gold + py + sap within (D,F) where early tectonic faults are cut by high angle normal faults
- Sulphide cress within D,F mudstone: 1 - 15 g/t Au
- oxide: <5 m thick @ < 7 g/t Au

KZB Oxide Au Pits (1400 m ASL) (Diamond and Xin Zuo, 2001 and submitted)
Southern China "Carlin-type" Gold Deposits

Regional Stratigraphy - SG1 (Nanshanling Belt, China)

Kuzhubao Prospect Geology & Oxide Gold Mining Pits

- Unconformity b/w Devonian Mudstones (D,P) and Cambrian Limestones (c_{2b})
- Reverse faulting along D,P and c_{2b} contact
- Later NW-SE strike-slip and NE-SW normal faults
Kuzhubao Gold Prospect - Pit # 3

- Kuzhubao Pit # 3: N - S low angle thrust faults cut by NW-SE normal faults.
- Unconformity by Devonian Mudstone (DIP) and Cambrian Limestone

Nickel-Copper deposits

Potential for Ni-Co-PGE deposits in Yunnan

1. Proterozoic Miocene Bay type (120 Mt @ 1.0% Ni with significant Co-Co-ore) (Kobrak, 1967)

2. Proterozoic Jinchuan deposit in Gejiu hosts copper Ni and Cu (Huang, 1967)

3. Permian Jinwuoo nickel sk type (120 Mt @ 2.7% Ni) (Huang, 1967)

VHMS and MVT deposits, Sichuan
Characteristics of Sediment-Hosted Gold Deposits in Sichuan Province, P. R. C.

Gold Mineralization (similarities to "Carlin-types")
- More disseminated sediment-hosted gold (refractory ore)
- Lepidocrocite occurring within graphitic shear zones with quartz & minor carbonate stock work veining and also along altered contacts with quartz-porphryritic dike (Allohoanic stage)
- Associated with pyrite, arsenopyrite, reeolite and epidote

Host Rocks:
- Devonian to Triassic-aged carbonaceous turbidites
- Occur as sequences within the Songpan-Garze accretionary wedge terrane, along the NW margins of the Xiangtang Orogen

Structural Setting:
- Dominant N-S & E-W trending regional faults (Paleozoic) cross-cut by later NNE & NE-trending faults (Mesozoic)

Cu-Ni deposits, Sichuan

Proterozoic Cu-Pb WMS (Lilingcang) & Jiangchuan Cu-Zn WMS (Jianco)
Potential for Ni-Cu-Co-PGE deposits in Sichuan
1. Permian to Triassic flood basalt type (K0 M @ 2.7 Ma) (Naidan, 1996)
2. Proterozoic: Silurian-Early Devonian type (136 Ma @ 1.295 Ma) with significant Cu-Co-Sn (Kazinite, 1997)
3. Ye'eluying (Permian) and Lingduoying and Luming (Proterozoic)

Cu-Ni deposits, Sichuan (Continued)

- Permian flood basalt's cover about 250,000 km2
- Major N-S regional structures along Kang Dian up-lift

- Palaeozoic ultramafic intrusions occur near basalt margins
- Small Ni-Cu mines occur with 1-4 % Ni, 0-5-2 % Cu & 0-05-3 g/t PGE
- Previous BHP sampling from 1994-1996 shows ultramafic intrusions with Ni depletion of olivines suggesting presence of Ni-sulphides elsewhere in the intrusions sampled (Paul Chromie, per. Com., 2000)
Mineral Deposits in South China II (P603)

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* Compilation of geology databases for Yunnan, Sichuan, Guizhou, Guangxi, Hunan, Guangdong, Jilin, Hubei, Anhui, Jiangsu, Fujian, Zhejiang and Shandong provinces have been completed.

* CD-ROMs are delivered to the sponsors.

* Mineral deposit database for the above provinces have been compiled.

* Yunnan has at least five different styles of lead-zinc mineralisation (e.g., skarn, VHMS, skarn, vein/breccia).

* Yunnan also has potential for Carlin type gold, porphyry, and epithermal deposits.
**Summary**

- Sichuan has potential for VMS, Carlin-type gold, porphyry, and mafic-ultramafic-hosted Ni-Cu deposits.
- Quzhou and Guangxi (part of Southern Golden Triangle) have Carlin-type gold, Sn-W-Au-Ag deposits (e.g., Juchang) and possibly of Sedex (e.g., Shiling).
- Yunnan's granitoid-related Au-W-Be-Au deposits are widespread in Hunan and Guangxi.
- Guangdong has Sedex deposits (e.g., Dakeosha, Fazhoushan) and mylonite-hosted mesothermal Au deposits.

**Summary**

- Jiazhi province has vein-type W, Sn-Bi-Fe-Au deposits and the largest porphyry Cu deposit in China (Beixing: 6.8 Mt, metal @ 0.43% Cu, 0.02% Mo, 0.16 g/t Au, and 1.8 g/t Ag).
- Jiazhi also has world-class Sedex-type deposits such as Changhongshan and Yuxian (4 Mt, metal @ 0.15-1.2% Cu, 124 g/t @ 0.25-0.5 g/t Au).
- Similar skarn Cu-Au deposits (e.g., Tonglingzhan, Yizhouzui, Jiaquandong, Xinglan, Minshan, Shiziquan) are also found in Hubei, Anhui, and Jiangsu along the Lower Yangtze River metallogenetic belt.

**Summary**

- Fujian and Zhejiang provinces cover South China foldbelts along the margin of the Yangtze Craton and characterized by well-developed Yanshanian intrusive to subvolcanic rocks.
- The most important examples are porphyry/maghemite-sulfidation Zijinshan deposit in Fujian (1.6 Mt, metal @ 1.68% Cu, 15 t @ 0.14 g/t Au, 619 t @ 0.2 g/t Ag) and epithermal/mesothermal transition deposits in Zhijiang (e.g., Zhilingta).
- Shandong province is a major producer of Au in China with reserves of >900 t Au and has unique world-class granitoid-hosted Au deposits (e.g., Lingshui, Nanhu, Jiaodong, Jiadong, >100 Au @ 3-30 g/t Au, av. > 5 g/t Au).
Summary

* We successfully interpreted the geology, tectonic and metallogenic relations of South China in this project.

* South China is rich in mineral resources and has the potential for world-class ore discoveries. In addition to existing ore types such as VHMS, Sedex, skarn, potential for new mineralisation such as IOCG (Iron Oxide Copper Gold) deposits is evident.

* Similarly, North China is rich in minerals. Many giant base metal deposits such as Baiyuncheng VHMS and Dongshenminuo Sedex and porphyry (Yulong) Ni-Cu-Ph-Pd deposits (Jinchuan) are located in the North China Craton and in the mature zone along the South and North China Cratons.

Summary

* It is imperative to undertake similar studies for North China Craton to understand paleogeographic, tectonic and metallogenic relations of formation of the giant ore deposits of North China during the collision and amalgamation of South China and North China Cratons.