



# LITHOS

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# Lithos

Volumes 168–169, Pages 1-236 (May 2013)

## ┌ Editorial Board

*Page IFC*

Invited Review Paper

## 2┌ **Using equilibrium thermodynamics in the study of metasomatic alteration, illustrated by an application to serpentinites**

Review Article

*Pages 67-84*

K.A. Evans, R. Powell, B.R. Frost

### ***Highlights***

► Theoretical aspects of equilibrium thermodynamics in the context of metasomatic rocks ► The importance of correct identification of length scales and driving variables ► Effects of protolith SiO<sub>2</sub> gradients and fluid infiltration during serpentinisation

Research Papers

## 3┌ **Petrology, geochemistry and Re — Os isotopes of peridotite xenoliths from Maguan, Yunnan Province: Implications for the Cenozoic mantle replacement in southwestern China**

Original Research Article

*Pages 1-14*

Chuan-Zhou Liu, Fu-Yuan Wu, Jing Sun, Zhu-Yin Chu, Xue-Hui Yu

### ***Highlights***

► Mantle xenoliths entrained in the Maguan basalts (*ca* 13 Ma) have fertile compositions. ► Whole-rock Re Os isotopes suggest that the Maguan mantle xenoliths are juvenile. ► Enriched lithospheric mantle beneath western Cathaysia block has been replaced by juvenile mantle. ► Mantle replacement probably occurred during the Early Miocene.

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### Mid-Triassic felsic igneous rocks from the southern Lancangjiang Zone, SW China: Petrogenesis and implications for the evolution of Paleo-Tethys

Original Research Article

Pages 15-32

Touping Peng, Simon A. Wilde, Yuejun Wang, Weiming Fan, Bingxia Peng

#### Highlights

► The Lincang batholith consists mainly of ~ 230 Ma and ~ 220 Ma granites. ► The peraluminous Lincang granites were derived from a crustal source. ► The A-type rhyolites resulted from mixing of crust- and mantle-derived magma. ► The mid-Triassic magmatism formed in a post-collision setting.

5

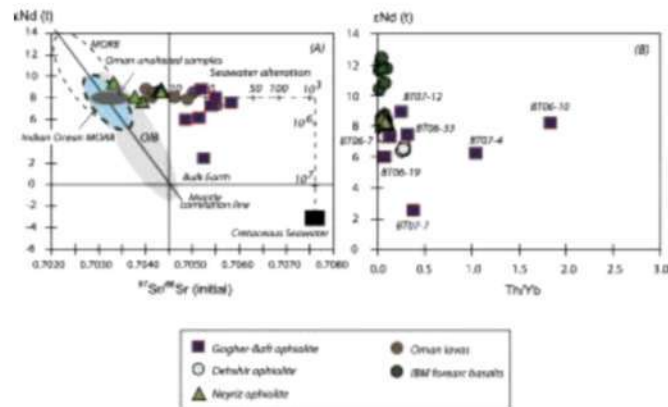
### Geochemistry and tectonic evolution of the Late Cretaceous Gogher–Baft ophiolite, central Iran

Original Research Article

Pages 33-47

Hadi Shafaii Moghadam, Robert J. Stern, Massimo Chiaradia, Mohamad Rahgoshay

#### Graphical abstract



#### Highlights

► Late Cretaceous Gogher–Baft ophiolite is a remnant of Neo-Tethyan Ocean. ► The ophiolite has MORB to forearc geochemical signature. ► Radiogenic Pb and less radiogenic Nd isotopes suggest the involvement of sediments. ► A subduction initiation model is proposed for generation of Gogher–Baft ophiolite.

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### Island arc-type bimodal magmatism in the eastern Tianshan Belt, Northwest China:

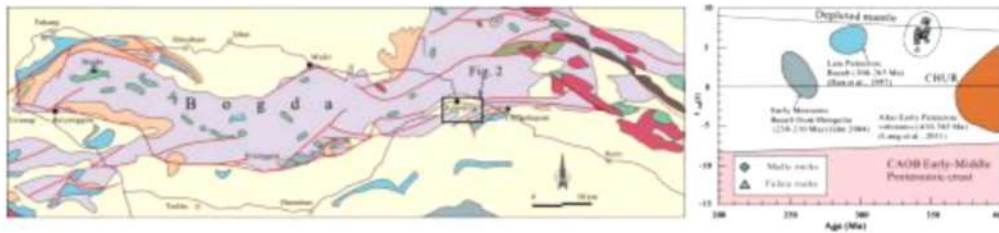
# Geochemistry, zircon U–Pb geochronology and implications for the Paleozoic crustal evolution in Central Asia

Original Research Article

Pages 48–66

Xijie Chen, Liangshu Shu, M. Santosh, Xixi Zhao

## Graphical abstract



## Highlights

► A bimodal volcanic event took place at around 345 Ma in the Eastern Tianshan orogenic belt. ► The basalts and rhyolites share a common relatively high initial  $\epsilon_{Nd}$  value and low  $Isr$ . ► Basalts were likely derived from a depleted mantle with partial crustal contamination. ► Rhyolites were likely formed by fractional crystallization from the basaltic magma. ► The bimodal volcanic suites were generated at a initial back-arc rift setting.

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## Ca. 1.5 Ga mafic magmatism in South China during the break-up of the supercontinent Nuna/Columbia: The Zhuqing Fe–Ti–V oxide ore-bearing mafic intrusions in western Yangtze Block

Original Research Article

Pages 85–98

Hong-Peng Fan, Wei-Guang Zhu, Zheng-Xiang Li, Hong Zhong, Zhong-Jie Bai, De-Feng He, Cai-Jie Chen, Chong-Yong Cao

## Highlights

► SIMS Zircon and baddeleyite U–Pb dating results reveal a  $\sim 1.5$  Ga age for the Zhuqing mafic intrusions. ► The intrusions were probably derived from a slightly enriched asthenospheric mantle source. ► They were generated under a continental rift environment likely related to the break-up of the supercontinent Nuna/Columbia. ► The Yangtze Block was likely a fragment of the Paleo- to Mesoproterozoic supercontinent Nuna/Columbia.

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**Crustal thinning and exhumation along a fossil magma-poor distal margin preserved in Corsica: A hot rift to drift transition?**

Original Research Article

*Pages 99-112*

Marco Beltrando, Ivan Zibra, Alessandra Montanini, Riccardo Tribuzio

**Highlights**

•

New finding of a rift-related shear zone accommodating crustal thinning in a distal continental margin.

•

New finding of a detachment fault accommodating the last stages of basement exhumation at the seafloor.

•

First example of ductile shearing at amphibolite facies conditions lasting until the rift-to-drift transition.

•

Sections of distal continental margins can be exhumed and cooled very rapidly in the last stages of rifting.

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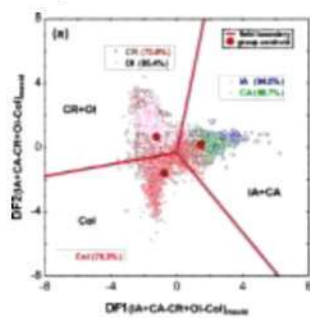
**Fifteen new discriminant-function-based multi-dimensional robust diagrams for acid rocks and their application to Precambrian rocks**

Original Research Article

*Pages 113-123*

Surendra P. Verma, Kailasa Pandarinath, Sanjeet K. Verma, Salil Agrawal

## Graphical abstract



$$DF1_{\text{CR=OI-CA=CA-Col}} = (0.051 \times \ln(\text{TiO}_2/\text{SiO}_2)_{\text{wt}}) + (0.226 \times \ln(\text{Al}_2\text{O}_3/\text{SiO}_2)_{\text{wt}}) + (-1.77 \times \ln(\text{Fe}_2\text{O}_3/\text{SiO}_2)_{\text{wt}}) + (1.83 \times \ln(\text{FeO}/\text{SiO}_2)_{\text{wt}}) + (-0.065 \times \ln(\text{MnO}/\text{SiO}_2)_{\text{wt}}) + (0.134 \times \ln(\text{MgO}/\text{SiO}_2)_{\text{wt}}) + (0.225 \times \ln(\text{CaO}/\text{SiO}_2)_{\text{wt}}) + (0.742 \times \ln(\text{Na}_2\text{O}/\text{SiO}_2)_{\text{wt}}) + (-1.78 \times \ln(\text{K}_2\text{O}/\text{SiO}_2)_{\text{wt}}) + (0.146 \times \ln(\text{P}_2\text{O}_5/\text{SiO}_2)_{\text{wt}}) - 2.12 \quad (1)$$

$$DF2_{\text{CR=OI-CA=CA-Col}} = (1.09 \times \ln(\text{TiO}_2/\text{SiO}_2)_{\text{wt}}) + (-1.65 \times \ln(\text{Al}_2\text{O}_3/\text{SiO}_2)_{\text{wt}}) + (-1.19 \times \ln(\text{Fe}_2\text{O}_3/\text{SiO}_2)_{\text{wt}}) + (1.03 \times \ln(\text{FeO}/\text{SiO}_2)_{\text{wt}}) + (0.82 \times \ln(\text{MnO}/\text{SiO}_2)_{\text{wt}}) + (0.026 \times \ln(\text{MgO}/\text{SiO}_2)_{\text{wt}}) + (0.023 \times \ln(\text{CaO}/\text{SiO}_2)_{\text{wt}}) + (0.212 \times \ln(\text{Na}_2\text{O}/\text{SiO}_2)_{\text{wt}}) + (0.085 \times \ln(\text{K}_2\text{O}/\text{SiO}_2)_{\text{wt}}) + (-0.85 \times \ln(\text{P}_2\text{O}_5/\text{SiO}_2)_{\text{wt}}) + 2.54 \quad (2)$$

## Highlights

► Multi-dimensional diagrams from correct statistical treatment of compositional data ► Fifteen new tectonomagmatic diagrams for acid magmas ► Robust diagrams against most chemical changes ► High success rates for tectonomagmatic discrimination ► Successful applications for inferring tectonic setting of acid rocks

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### Albitization in the Antimony Line, Murchison Greenstone Belt (Kaapvaal Craton): A geochemical and geochronological investigation

Original Research Article

Pages 124-143

Justine Jaguin, Philippe Boulvais, Marc Poujol, Valérie Bosse, Jean-Louis Paquette, David Vilbert

## Highlights

► Albitites in the Murchison Greenstone Belt are related to Sb-fluid mineralization. ► Albitites developed at the expense of granodiorites plugs. ► There was likely a magmatic-related primary mineralization at 2.97–2.92 Ga. ► At ca 2.80 Ga, a crustal fluid triggered the albitization and the Sb-secondary mineralization.

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### Compositional diversity of ca. 110 Ma magmatism in the northern Lhasa Terrane, Tibet: Implications for the magmatic origin and crustal growth in a continent-continent collision zone

Original Research Article

Pages 144-159

Qing-Lin Sui, Qing Wang, Di-Cheng Zhu, Zhi-Dan Zhao, Yue Chen, M. Santosh, Zhao-Chu Hu,

### Highlights

► Compositionally diverse magmatism was synchronously emplaced at ca. 110 Ma. ► Basalts originated from a heterogeneous mantle source modified by subduction process in an extensional setting. ► Adakitic rocks resulted from magma mixing between the melts from thickened lower crust and mantle-derived basaltic magmas. ► Diverse magmatism witnessed the slab break-off of the southward Bangong–Nujiang Ocean lithosphere subduction. ► Extensive magmatism of ca. 110 Ma contributed to the crustal growth of the northern Lhasa subterrane.

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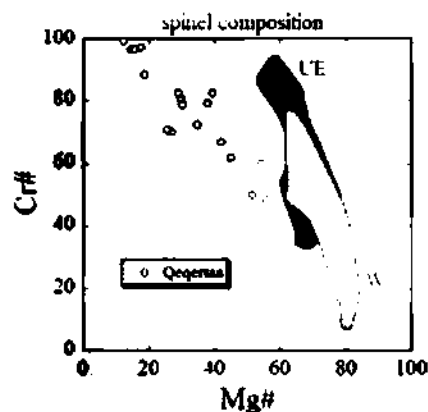
### Highly depleted cratonic mantle in West Greenland extending into diamond stability field in the Proterozoic

Original Research Article

Pages 160-172

Stefan Bernstein, Kristoffer Szilas, Peter B. Kelemen

### Graphical abstract



### Highlights

► We present EMP data for a new suite of dunite xenoliths from a lamprophyre dyke in West Greenland. ► Olivine Mg# averages 92.6 and garnet is present together with macrodiamonds. ► Spinel Cr# for this suite appears overprinted by metamorphism and formation of mica coatings.

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**Petrogenesis of the Neoproterozoic West Highland Granitic Gneiss, Scottish Caledonides: Cryptic mantle input to S-type granites?**

Original Research Article

*Pages 173-185*

M. Fowler, I.L. Millar, R.A. Strachan, A.E. Fallick

**Highlights**

► We provide the first comprehensive elemental and isotopic study of these metamorphosed intrusions. ► They are derived by metasediment anatexis but have incorporated significant juvenile material. ► Restite entrainment and inefficient melt extraction are important influences on their primary geochemistry. ► Subsequent hydrothermal alteration has affected Sr and O isotope systems.

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**The Carboniferous ophiolite in the middle of the Qiangtang terrane, Northern Tibet: SHRIMP U–Pb dating, geochemical and Sr–Nd–Hf isotopic characteristics**

Original Research Article

*Pages 186-199*

Qing-guo Zhai, Bor-ming Jahn, Jun Wang, Li Su, Xuan-Xue Mo, Kuo-lung Wang, Suo-han Tang, Hao-yang Lee

**Highlights**

► Ophiolitic mélanges occur in the middle of the Qiangtang terrane, northern Tibet. ► These features are comparable with those of N-MORB and/or E-MORB. ► Zircon SHRIMP U–Pb analyses indicate that they were formed in the Early Carboniferous. ► They marked a Paleo-Tethys Ocean basin.

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**Large volumes of anatectic melt retained in granulite facies migmatites: An injection complex in northern Quebec**

Original Research Article

*Pages 200-218*

S. Morfin, E.W. Sawyer, D. Bandyayera



### **Highlights**

► A large volume of anatectic melt has accumulated in the deep middle crust. ► The terrane contains over 60% leucogranite, but ~ 10% is from in situ partial melting. ► Pervasive migration of leucogranite formed an injection complex of innumerable small dykes.

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### **Structural and petrological analyses of the Frido Unit (southern Italy): New insights into the early tectonic evolution of the southern Apennines–Calabrian Arc system**

Original Research Article

*Pages 219-235*

Stefano Vitale, Lorenzo Fedele, Francesco D'Assisi Tramparulo, Sabatino Ciarcia, Stefano Mazzoli, Alessandro Novellino

### **Highlights**

► We provide petrological and structural analyses of the OCT-derived Frido Unit. ► Carpholite and Na-amphibole crystals were found in the metapelites and phyllites. ► A P-T-t path was provided and compared with others metamorphic units. ► A tectonic evolution model for the Calabria–Lucania border is proposed.

Corrigendum

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### **Corrigendum to “Is Myanmar jadeitite of Jurassic age? A result from incompletely recrystallized inherited zircon” *Lithos* 160–161 (2013) 268–282**

*Page 236*

Tzen-Fu Yui, Mayuko Fukuyama, Yoshiyuki Iizuka, Chao-Ming Wu, Tsai-Way Wu, J.G. Liou, Marty Grove