Geochemical and Sr-Nd isotopic characteristics of Dongbei basalts 
in Huichang area, Jiangxi Province, and their geological implications

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Abstract

The Late Mesozoic Dongbei basalts, located in Huichang area of Jiangxi Province, have SiO₂ contents of 49.06% ~ 50.14% and K₂O 1.26% ~ 1.63%. They are rich in large-ion lithophile elements and poor in high field strength elements, and have ∑REE of (135.5 ~ 146.8) × 10⁻⁶, (La/Yb)N of ca. 10 and LREE enrichment, with strong negative Nb and Ta anomalies and no obvious Eu anomalies in the MORB-normalized spider diagram. The Sr-Nd isotopic compositions show that Dongbei basalts have high initial ⁸⁷Sr/⁸⁶Sr ratios of 0.70678 ~ 0.70695 and low εNd(t) of −2.46 ~ −2.18. These geochemical characteristics indicate that the
Dongbei basalts might have been derived from the source of EM II-type lithospheric mantle under the tectonic setting of an active continental margin. The low values of Nb/U (7 ~ 8) suggest that the basalts probably experienced the addition of some subduction-related materials and/or a certain degree of crust contamination. The characteristics of the Dongbei basalts are similar to those of the basalts with the tectonic settings of an active continental margin, indicating that Huichang area lays in an active epicontinental environment during the late stage of Late Cretaceous (ca. 85 Ma). The Dongbei basalts might have had an intimate contact with the paleo-Pacific plate subduction underneath the Eurasia plate in the late Yanshanian period. The basaltic underplating may have provided fluid components and heat for the metallogenic magma of Huichang area during the late Yanshanian period, which contributed to the formation of copper deposits.

**Key words:** geochemistry, Sr-Nd isotopic component, basalt, EM II mantle source, active continental margin, Huichang, Jiangxi
的晚白垩世砂岩、泥岩夹火山岩的沉积序列
赣州群),岽背玄武岩即产于这套含火山岩的沉积序列之中。岽背玄武岩出露于岽背村附近,长约
宽不等,呈向展布,其走向与会昌盆地内晚白垩世的沉积岩几乎平行,向北很可能延伸至站塘一带(图
岽背玄武岩岩性单一,呈灰黑色,致密块状构造,部分露头风化后为褐红色(图)。在站塘一带,除玄武岩之外,更多出露的是高钠安山岩(,,-/012+34
站塘安山岩与玄武岩可能有着时间和空间上的耦合关系,但前人研究认为,后者并非前者的母岩(,,-/012+34
岽背玄武岩的两侧均见有晚白垩世茅店组下段的紫红色泥岩、粉砂岩。周济元等(,###
将岽背玄武岩与其北的站塘安山岩都归于茅店组下段,认为其喷发很可能与石城5寻乌断裂有关(周济元等,
从野外接触关系看,岽背玄武岩的两侧均见有晚白垩世茅店组下段的紫红色泥岩、粉砂岩。周济元等(,###
判断东莞玄武岩的年龄为,是燕山晚期火山活动的产物。

岩相学特征
岽背玄武岩由斑晶和基质组成,斑晶与基质的比例为(>'?,呈斑状结构,基质具间粒
该玄武岩的斑晶主要为橄榄石、辉石及少量斜长石。橄榄石斑晶的粒度一般为#:!
含量大于@A;辉石斑晶主要呈自形短柱状,以单斜辉石为主(图;斜长石斑晶呈板状,长约
该玄武岩的基质成分为微晶辉石和斜长石,以及少量橄榄石和不透明矿物。基质中的斜长石约占@A

Fig. 1 Regional location of the study area a and distribution of Dongbei basalts b after Xiong et al. 2003
岽背玄武岩野外照片,部分露头岩石呈褐红色;岽背玄武岩中有较多的红褐色伊丁石或伊丁石化的橄榄石斑晶;岽背玄武岩的主要矿物:伊丁石、单斜辉石、斜长石;岽背玄武岩中伊丁石化的橄榄石和伊丁石;石、磁铁矿及隐晶质充填其中。基质斜长石的最大消光角;

岩石中有较多的红褐色粒状矿物(图!$),经镜下鉴定为伊丁石或伊丁石化的橄榄石(图!%、!'。伊丁石可能是橄榄石在低温及氧化条件下发生蚀变的产物(王德滋等, FNO!),且可能形成于陆相环境。地球化学特征

样品和实验方法
基于野外观察和室内细致的岩相学研究,选出岽背地区!个具有代表性的玄武岩样品进行了全岩主量元素、微量元素以及P4QC'同位素分析。所分析的岩石样品采自岽背村路旁溪沟边的基岩,岩石较为新鲜,受蚀变程度较低。

全岩主量元素分析的实验方法 将样品(粒度! EE目)约!1在FEER的烘箱内烘$小时,保存在干燥器中,$小时后,首先进行样品烧失量的分析。放瓷坩埚在天平上,归零,准确称取FSH!FSL1样品于瓷坩埚中,称得样品净重,放入NEER的高温炉中灼烧TE分钟后取出,稍微冷却后放入干燥器中冷却$I小时,称样品加坩埚重,倒出样品(保留样品于干燥器内,备做UV/玻璃片),称空坩埚重。然后,第O卷 第L期 励音骐等:江西会昌岽背玄武岩地球化学和P4QC'同位素特征及其地质意义

Fig. 2 Field and microscope photographs of Dongbei basalts

a. Field photo showing Dongbei basalts partly with rufous outcrop b. Lots of rufous iddingsite or iddingsitized olivine porphyroblasts in Dongbei basalts c. Major minerals in Dongbei basalts iddingsite Idn chlino.pyroxene Cpx plagioclase PIl d. Iddingsitized olivine Idn and iddingsite Idn in Dongbei basalts
XRF  4.0000 g Li2B4O7  250°C overnight  XRF  0.4 g 1 % LiBr  0.5 % NH4I  XRF  200°C  XRF

1% 0.5000 g  900°C  0.4

49.06 % ~ 50.14 % TiO2  0.92 % ~ 1.00 %

Al2O3  15.23 % ~ 15.86 % K2O + Na2O  3.99 %

~ 4.51 % P2O5  0.25 % [Mg2+]  41.6 %

~ 47.3 % [Mg2+] TAS  ~ 1.26 % ~ 1.63 %

Xiong et al., 2003

SiO2  2004

3

MORB  4

K[ReB5]

Th  Nb  Ta  Zr  Hf  Ti  Yb  4

Ta  Nb  Yb  4

4

Zhou et al., 2006

0.18 g  1.2 ml

1:1 HNO3  1.2 ml

100°C  15 ml  4 ~ 6

6N HCl  1 ml

100°C  1 ~ 2 ml

2 ml Milli-Q  1 ml

4 % H3BO3

100°C  2 ml Milli-Q  AG50-8X

Sr  REE  AG50-8X

REE  0.8 ml  0.174N HCl

HDEHP  Nd  Sr-Nd  MicroMass Isotope

3.2

0.85 % ~ 0.94 % 2002

2

REE  135.50 ~ 146.80 \times \times 10^{-5}

LREE  HREE  8.97 ~ 9.00  La/Yb\textsubscript{N} \approx 10

REE  HREE  REE  Eu  Eu^+

Xiong et al., 2003

4

3.3

Sr-Nd

Sr-Nd  Nd  Sr  Nd  87 Sr

86Sr  0.70678 ~ 0.70695 \epsilon Nde  t = - 2.46

~ 2.18  2

Sr-Nd  2

\epsilon Nde  t = 0.021 \epsilon Nde
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<th>J5-3</th>
<th>J6-2</th>
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注: 站塘玄武岩的资料引自 [X-Q:;8Y=41]。
Table 2  Sr-Nd isotopic analyses of Dongbei and Zhantang basalts

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</tbody>
</table>

Fig. 4  Primitive mantle-normalized spider diagram for Dongbei basalts

Normalization values of MORB from Peate [1982]. Shade area representing data from the Late Yanshanian basalts in the coastal areas of SE China after Zhou et al. [2006].

Fig. 5  CI chondrite-normalized REE pattern for Dongbei basalts. Normalization values of CI chondrite are from McDonough et al. [1989].

Sr-Nd  εNd  t(Ma)  εNd  t(Ma)
87Sr/86Sr  0.7037 ± 0.0009  0.7036 ± 0.0009
87Sr/86Sr  0.7037 ± 0.0009  0.7036 ± 0.0009

Fig. 6  TAS diagram for Dongbei basalts. Data of Zhantang basalts from Xiong et al. 2003.

Fig. 7  TAS diagram for Dongbei basalts. Data of Zhantang basalts from Xiong et al. 2003.
岽背和站塘玄武岩的(图解)(底图引自范蔚茗等)(2003)

- 0.45$^{87}$Sr/$^{86}$Sr, 0.70678 ~ 0.70695
- $\epsilon$Nd, 6.02

Hf/3-Th-Ta (图)(据Wood(1980)

- 85 Ma
- 70 Ma

Sr-Nd(图)(据Zhou et al. (2006)
岽背玄武岩为橄榄拉斑玄武岩,属中钾至高钾的钙碱性系列岩石。岽背玄武岩具有陆缘弧型岩石地球化学特征,可能来自者,很可能与俯冲消减作用将更多的陆壳物质带入侵上涌,不仅提供了热源,亦可引起地壳重熔或同熔,导致一系列与盆地火山岩有关的岩石圈地幔有关。正是在这种环境下,深部岩浆底结 论

References


