

行政院國家科學委員會專題研究計畫 成果報告

感應耦合電漿質譜術之建立與應用 (II): 東南亞大陸地殼的 化學組成

計畫類別：個別型計畫

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感應耦合電漿質譜術之建立與應用(II)成果報告

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： 計畫主持人 台大地質科學系 鍾孫霖

： () 計畫參與人員 朱美妃 博士生 、 駱宜民 碩士生

一、中文摘要

本研究計畫設計為一個三年期專題計畫 但將分年申請研究經費且應用研究不同的內容。第一年已利用新購之 Agilent (原 HP) 7500s ICP-MS 設備建立一種利用強酸密封溶解岩石樣品、以美國地調所標準岩樣作參考標準、另加若干質量監控溶液作為內標 分析岩石中大約四十種微量元素的方法。此一分析方法具有簡單、準確、同時測量多元素等優點 能夠快速有效地分析大多數常見的岩石樣品。第二年主要針對東南亞的大陸地殼進行系統採樣以分析其化學組成 並與周邊地區如華南、青藏高原等對比 成果正在整理中即將依序發表。

； 關鍵詞 感應耦合電漿質譜術 微量元素分析

Abstract

This project is proposed as a three-year project to develop the quadrupole ICP-MS, i.e., a new Agilent (originally HP) 7500s, has been installed in this department for potential applications in geosciences and environmental sciences. In the first year,

the analytical procedures which would enable the ICP-MS to precisely and simultaneously determine about 40 trace elements in rock samples has been established. The procedures includes: (1) digestion of rock samples using distilled HF+HNO₃ in screw-top teflon beakers in the clean room, (2) digestion of USGS and other rock standards through the same processes and then using them as calibration references, and (3) using certain internal standards during the measurements to monitor the sensitivity shift of the machine. Consequently, the ICP-MS method developed marks with: (1) simple sample preparation, (2) straightforward data reduction, and (3) high analytical precision, and thus can be applicable to trace element determinations of common rock samples.

Keywords: ICP-MS; Trace element determinations

二、緣起與目的

感應耦合電漿質譜術 (Inductively Coupled Plasma- Mass Spectrometry 簡稱 ICP-MS) 由於具有精確、靈敏度高、譜線相對單純、動態範圍廣、可同時進行多元素快速分析等優點 從 90 年代開始已經成為測量大部份地質樣品的微量元素含量的最佳工具。早期的 ICP-MS 因為靈敏度容易發生飄移 一些實驗室於是採用標準加入法、同位素稀釋法或多元素同位素內標法等設法予以克服。近年來陸續推出的新一代 Quadrupole ICP-MS 如 PE Elan 6000+ 型、VG PQs 型、HP 4500+ 型等 不僅在分析能力和穩定性上均較早期機種有了顯著的改善 還將整個分析流程從點火、調協、分析操作到數據處理自動化 可以電腦程式全程操控。

三、結果與討論

， 台大地質系蒙貴會專款補助 已購置一套 Agilent (原 HP) 生產之最新型

7500s ICP-MS 設備 本研究計畫的第一年裡嚐試建立各種微量分析方法 目前已能對常規岩石樣品進行高精確度之微量含量分析 可同時測量其內普遍含有的 ppm 級元素約 40 種 一般分析的精、準確度估計均可達 2-5%。此外 並已針對一些難溶於酸的岩石標本 如花崗岩、變質岩等 先添加助溶劑製成玻璃餅再由該餅置備溶液 進行分析。後者的精、準確度也已達到 5% 左右。換言之兩種溶樣方法都已達到預定的測試目標並因此能應用於各類實際岩石標本的微量元素分析。

(四、) 出席國際會議心得報告 朱美妃

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會議心得 第一次出國參加國際學術會議並發表論文 收穫很多。所發表之論文以壁報展示期間 曾獲許多從事相關領域的知名學者的探視和討論 尤其能夠與一些原先「僅讀其文、未見其人」的學者進行面對面的對談 深感收穫良多。在會議的諸多口頭論文宣讀上 還聽到許多國際一流學者的精彩的最新研究報告 頗有啟發。希望在未來更加努力 有機會繼續多參加這樣的國際學術會議並發表新的研究成果 在國際學術研究的舞台上 占一席之地。

發表論文

Post-collisional potassic magmatism on the Tibetan plateau: Temporal and spatial evolution

Mei-Fei Chu¹, Sun-Lin Chung¹, Yuquan Zhang², Yingwen Xie², Ching-Hua Lo¹, Tung-Yi Lee³

1. Department of Geosciences, National Taiwan University, Taipei, Taiwan
2. Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, China
3. Department of Earth Sciences, National Taiwan Normal University, Taipei, Taiwan

The collision of India with Asia since early Cenozoic time resulted in the Tibetan plateau and surrounding mountain ranges. Despite numerous investigations in the region, the geodynamic processes that accounted for the formation and evolution of the plateau remain highly controversial. To better understand these processes, we present new chronological and geochemical data of post-collisional magmas from eastern Tibet. The magmas range from mafic to felsic compositions. They are potassic, enriched in the large ion lithophile and light rare earth elements, and depleted in Nb, Ta and Ti, suggesting a metasomatized continental lithospheric mantle origin. Combining with published information from the western part of the plateau, three episodes of post-collisional potassic magmatism characterized by similar geochemical features can be identified in different localities. These are: (1) 40-30 Ma group from the eastern Qiangtang terrane, eastern Tibet, (2) 25-16 Ma group from the Lhasa terrane, southern Tibet, and (3) <15 Ma group from the western Qiangtang and Songpan-Ganze terranes, northern Tibet. Each group, moreover, marks with distinctive trace elemental and isotopic signatures. This temporal and spatial variation indicates a heterogeneous nature of the Tibetan lithospheric mantle, which we infer to have resulted from enrichment events that occurred prior to the terrane accretion. Such heterogeneity implies that variation in the compositional, and/or thermal, structure of the Tibetan lithosphere could have placed an important control on the timing and places of the magmatism, and supports the notion that diachronous removal of thickened lithosphere took place in the Tibetan plateau.

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