

ห้องสมุดงานวิจัย สำนักงานคณะกรรมการวิจัยแห่งชาติ



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ORIGIN OF BASALT BRECCIA, BAN SAP SAWAT, WICHIAN
BURI DISTRICT, PHETCHABUN PROVINCE

JONGKONNEE KHANMANEE

MASTER OF SCIENCE

IN GEOLOGY

THE GRADUATE SCHOOL

CHIANG MAI UNIVERSITY

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**A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN
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17 September 2009

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บทคัดย่อ

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ชุดหินบะซอลต์บ้านซำสวัสดิ์ เป็นส่วนหนึ่งของหินบะซอลต์วิเชียรบุรี ปกคลุมพื้นที่ประมาณ 45 ตารางกิโลเมตร และประกอบด้วยชุดลักษณะหินภูเขาไฟหลัก 3 แบบ ได้แก่ หินลาวา หลาก หินกรวดเหลี่ยม และหินตะกอนภูเขาไฟ หินกรวดเหลี่ยมบะซอลต์ มีทั้งแบบเมทริกซ์เด่น และแบบคลาสต์เด่น ประกอบด้วยเศษหินบะซอลต์ ที่มีลักษณะเป็นเหลี่ยมถึงกึ่งมน และมีขนาดแตกต่างกัน ผังตัวอยู่ในเมทริกซ์ที่มีขนาดละเอียดกว่า และประกอบด้วยเศษหินเนื้อแก้วที่เปลี่ยนแปลงอย่างมาก เป็นส่วนใหญ่ พูฟิลโลและเศษหินฟิลโลเกิดร่วมกับหินกรวดเหลี่ยมบะซอลต์ในบางบริเวณ หินตะกอนภูเขาไฟ ได้แก่ หินทรายและหินทรายเนื้อกรวด ที่ประกอบด้วยคลาสต์ของหินบะซอลต์เนื้อแก้ว

หินลาวาหลาก และคลาสต์ขนาดกรวดใหญ่และก้อนหินมนใหญ่ในหินกรวดเหลี่ยม มักแสดงเนื้อผลึกสองขนาด โดยมีแร่ดอก/แร่จุดดอกเป็น โอลิวีน และแพลจิโอเคลส ในจำนวนที่แตกต่างกัน หินบะซอลต์เนื้อเซริเอตมีน้อยมาก กราวเมสของหินลาวาหลาก มีเนื้อหินแบบผลึก ล้วน และแบบผลึกผสมแก้ว กราวเมสของคลาสต์ขนาดกรวดใหญ่และก้อนหินมนใหญ่ มีเนื้อหินแบบผลึกผสมแก้ว กราวเมสเนื้อผลึกล้วนประกอบด้วยแท่งแพลจิโอเคลสที่วางตัวไม่เป็นระเบียบ เป็นส่วนใหญ่ แร่ที่มีปริมาณรองลงมา ได้แก่ ไคลโนไพรอกซีนและโอลิวีน แร่ที่มีปริมาณน้อย เป็นเหล็ก-ไทเทเนียมออกไซด์ กราวเมสเนื้อผลึกผสมแก้ว ประกอบด้วยแท่งแพลจิโอเคลสที่วางตัว

ไม่เป็นระเบียบและแก้วทาคีไลต์ เป็นส่วนใหญ่ แร่ที่มีปริมาณน้อยเป็นโอลิวีน หินเนื้อเซริเอต ประกอบด้วยแท่งแพลจีโอเคลสและไคลโนไพรอกซีน ที่แสดงลักษณะเนื้อแบบโอพิติก/สับโอพิติก

หินกรวดเหลี่ยมแบบเมทริกซ์เด่น ประกอบด้วย คลาสต์ขนาดคินดิงทราย ที่เปลี่ยนสภาพอย่างมาก คลาสต์ขนาดกรวดเล็กและกรวดกลางมีจำนวนน้อย คลาสต์ขนาดกรวดเป็นหินบะซอลต์ที่แสดงเนื้อไวโทรไฟริก โดยมีแร่ดอกและแร่จุดดอกเป็นโอลิวีนและแพลจีโอเคลส องค์ประกอบของกราวเมสที่พบบ่อยมากเป็นแก้วซีเดอโรไมเลน องค์ประกอบของกราวเมสที่พบน้อยได้แก่ ผลึกโอลิวีนและแพลจีโอเคลส ที่เกิดจากการเย็นตัวอย่างเร็วมาก และแก้วทาคีไลต์สีน้ำตาลเข้ม แก้วซีเดอโรไมเลนที่เกิดเป็นกราวเมสตามขอบของคลาสต์แต่ละอัน เปลี่ยนเป็นแก้วพาลาโกไนต์สีน้ำตาลเข้ม เป็นส่วนใหญ่ และแก้วพาลาโกไนต์สีน้ำตาลเงินและสีน้ำตาลอมเขียว บ้างเล็กน้อย โพรงที่มีผนังเนื้อแก้วเปลี่ยนแปลงเป็นแก้วพาลาโกไนต์ และ/หรือคอลลอยด์สีน้ำตาลและสีน้ำตาลอมเขียว และถูกแทนที่โดยซีโอไลต์และแร่ดิน ปรากฏให้เห็นในจำนวนที่แตกต่างกัน

หินลาวาหลาก คลาสต์ขนาดกรวดใหญ่และก้อนหินมนใหญ่ และหินกรวดเหลี่ยมแบบเมทริกซ์เด่น มีส่วนประกอบทางเคมีคล้ายกัน ซึ่งมีนัยสำคัญว่าหินเหล่านี้ เกิดจากการเย็นตัวของหินชนิดอันเดียวกัน หินดังกล่าว มีส่วนประกอบทางเคมีเป็นหินโทเลไอต์กำลังที่วิวัฒนาการ และมีส่วนประกอบอยู่ในช่วงที่แคบ ซึ่งควบคุมโดยการแยกตัวออกไปของโอลิวีนและแพลจีโอเคลสเป็นส่วนใหญ่ หินที่ทำการศึกษา มีรูปแบบธาตุหายากโดยใช้คอนไดรต์เป็นตัวหาร และรูปแบบธาตุรวมโดยใช้หินบะซอลต์ที่เกิดตามสันเขากลางมหาสมุทรชนิดปกติเป็นตัวหาร คล้ายกับหินโทเลไอต์อายุไมโอซีนตอนต้นถึงตอนกลาง จากซิงก์โหด-อะลิน และสะชะลิน ซึ่งอยู่ทางด้านขอบตะวันออกเฉียงเหนือของแผ่นทวีปยูเรเชีย และปะทุในสภาวะแวดล้อมแบบการแยกตัวของแผ่นทวีป

ความคล้ายกันของหินลาวาหลาก และคลาสต์ในหินกรวดเหลี่ยมบะซอลต์ ในรูปของชุดแร่ดอก/แร่จุดดอก และส่วนประกอบทางเคมี มีนัยสำคัญว่า หินเหล่านี้ เกิดจากหินหนืดโทเลไอต์กำลังภายในพื้นทวีป กราวเมสเนื้อผลึกล้วนและเนื้อผลึกผสมแก้วของหินลาวาหลาก และคลาสต์เนื้อแก้วและเนื้อผลึกผสมแก้วของหินกรวดเหลี่ยม แสดงว่า กราวเมสของหินลาวาหลากมีอัตราการเย็นตัวช้ากว่าคลาสต์ของหินกรวดเหลี่ยม ซึ่งเป็นผลของการแตกแบบอัดโนมัติ เนื่องมาจากการทำปฏิกิริยาของหินหนืดที่ร้อนกับน้ำเย็น (เย็นตัวอย่างเร็วมาก) การปรากฏของฟูลิลโล เศษหินฟูลิลโล และหินเพเพอไรต์เป็นหลักฐานของหินลาวาหลากได้น้ำ แท่งภาพธรณีของชุดหินบะซอลต์บ้าน

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ซัปส์วัตต์เทียบเคียงได้กับสถาปัตยกรรมของชุดลักษณะหินภูเขาไฟที่เกิดพร้อมกันของหินลาวาหลากได้น้ำ ดังนั้น หินกรวดเหลี่ยมบะซอลต์เป็นหินกรวดเหลี่ยมอต์โนมิติ ที่เกิดจากการแตก เนื่องจากการเย็นตัวอย่างรวดเร็ว

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ABSTRACT

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The Ban Sap Sawat basaltic suite, part of Wichian Buri Basalt, Phetchabun Province, covers an area of about 45 km² and is constituted by three main types of volcanic lithofacies, including lava flows, breccias and volcanogenic sedimentary rocks. The basalt breccias are either matrix-supported or clast-supported, and consist of poorly sorted, angular to subrounded, basalt fragments, sitting in the finer-grained matrix, which is largely made up of highly altered, glassy fragments. Pillow lobes and pillow fragments have also been observed in association with the basalt breccia in some places. The volcanogenic sedimentary rocks include sandstone and conglomeratic sandstone that are made up of glassy basaltic clasts.

The lava flows, and cobble- to boulder-grade clasts in breccias are commonly porphyritic, with variable amounts of olivine and plagioclase phenocrysts/microphenocrysts; seriate-textured basaltic rocks are rare. The groundmass of lava flows are holocrystalline to hypohyaline, while that of cobble- to boulder-grade clasts are hypohyaline. The holocrystalline groundmass consists mainly of felted plagioclase laths, with subordinate clinopyroxene and olivine, and a small amount of Fe-Ti oxide grains. The hypohyaline groundmass consists mainly of felted

plagioclase laths and tachylite, and a small amount of olivine grains. The seriate-textured rocks are made up largely of plagioclase and clinopyroxene that mostly show ophitic/subophitic relationships.

The matrix-supported breccias consist largely of highly altered, clay- to sand-grade clasts, with minor granule- to pebble-grade clasts. The gravel-grade clasts are strongly vitrophyric basalts, with olivine and plagioclase phenocrysts/microphenocrysts. Their groundmass constituents are common yellowish brown sideromelane, and uncommon quench crystals of olivine and plagioclase, and dark or blackish brown tachylite. At rims of individual clasts, the original groundmass sideromelane has been commonly replaced by dark brown palagonite, with minor bluish and bluish green palagonite. Vesicles, commonly with brownish/bluish green palagonite- and/or chlorite-altered glassy walls, and infillings of zeolites and clay minerals, are variably present.

The analyzed lava samples, cobble- to boulder-grade clasts and matrix-supported breccias have similar chemical compositions, signifying that they were solidified from the same magma. The rocks are chemically evolved, transitional tholeiites that have narrow compositional ranges, mainly controlled by removal of olivine and plagioclase. Their chondrite-normalized REE patterns and N-MORB normalized multi-element patterns are closely analogous to the Early-Middle Miocene tholeiites, Central Sinkhote-Alin and Sakhalin, northeastern margin of the Eurasian continent, which were erupted in a continental rift environment.

The similarity of lava flows and clasts in basalt breccia, in terms of phenocryst/microphenocryst assemblage (olivine + plagioclase) and chemical compositions, signifies that they have been formed from the same continental within-plate, transitional tholeiitic magma. The holocrystalline to hypohyaline groundmass of lava flows and the glassy to hypohyaline clasts of breccias show that the former has slower cooling rates than the latter, which is the product of autobrecciation formed by the interaction between hot magma and cold water (quenching). The occurrences of pillow lobes, pillow fragments and peperites are also evidenced for subaqueous lava

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flows. The graphic logs of the Ban Sap Sawat basaltic suite are matched with the architecture for contemporaneous volcanic facies that develop in association with the emplacement of subaqueous lava flow. Accordingly, the basalt breccia is autobreccia produced by quench fragmentation.

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