
SHORTER COMMUNICATION

PETROGRAPHIC ANALYSIS OF THIN-SECTIONS OF
SAMPLES FROM TWO MONOLITHIC STATUES (*MOAI*),
RAPA NUI (EASTER ISLAND)

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The major rock formations of Easter Island have received considerable geological attention including petrographic and geochemical characterisation (Baker 1993, Baker and Buckley 1974, Dérulle *et al.* 2002). Hawaiite, basalt, mugerite, benmoreites and felsic flows, and pyroclastic deposits dominate (Baker and Buckley 1974: 89). These flows, and their weathered products, supplied the raw materials for construction of prehistoric house foundations, tools and the justly famous megalithic religious architecture complex (*ahu*).

Two patterns of monolithic statue (*moai*) production are archaeologically documented. Of 887 *moai* inventoried to date on 210 sites fully 95 percent originated in a single production zone: Rano Raraku quarry. Located within the lower-ranked of two ethnographically recorded political districts (Routledge 1919: 221-24, Fig. 91), Rano Raraku was initially a direct access quarry available to autonomous related groups. The stone is a tephra ash deposit laid down in thin horizontal layers. Most of the statues were cut with the bedding of the tuff; some were cut at an angle or perpendicular to the bedding. Recent digital mapping within Rano Raraku suggests the possibility of linking individual statues to discrete quarries or specific procurement zones and then to one of two ethnographically described regional socio-political divisions (Van Tilburg *et al.* 2008).

About five percent of the *moai* corpus was carved of volcanic rock quarried elsewhere than Rano Raraku. This suggests withdrawal from the larger procurement pattern, perhaps owing to independence or restricted access. Ericson (1984: 7) noted that as lithic

production societies grew, territorial borders became fixed and land use more proscribed. He suspected that "direct access procurement" was then "abandoned or limited to the people of the local region". Changes in social organisation might follow.

A subset of 80 authenticated monolithic and portable sculptural objects (*moai maea*) of stylistic importance are in non-archaeological contexts, e.g., museums or collections (Van Tilburg 2006). Most have little or no specific provenance. The stone of which they are carved has not been analysed and is typically described as "basalt" (18 objects), "trachyte" (35 objects) or "red stone" (27 objects). Figueroa G-H and Sanchez (1965: 171) pointed out the difficulty of sourcing basalt adzes on Rapa Nui "without detailed petrographic analysis". Weisler (1993) reviewed standards and applications for geochemical provenance studies of basalt adze material and has shown the usefulness of such studies in outlining prehistoric interaction between Pacific islands (see also Collerson and Weisler 2007, Weisler 1998).

An intact *moai* now in the collection of the National Museum of Natural History (NMNH), Smithsonian Institution, Washington, D.C. is included in the authenticated sculptural subset. It was collected by Paymaster W.J. Thomson of U.S.S. *Mohican* in 1886.¹ It was originally located on the inland ceremonial site of Ahu O'Pepe (20-001) with seven other statues of Rano Raraku tuff (Van Tilburg 2006: 52-55).² The material of which it is carved is described on the accession card as "stone," and a head collected at the same time from the same site is said to be "composed of, or cut from [a] substance resembling sand stone."³ The visual character of the statue's dorsal surface some 120 years after collection is smooth and dark to nearly black. On the ventral surface near the base, conglomerate is present. As visual examination alone did not establish stone type (Heyerdahl 1975: Plate 6 suggested tuff; Van Tilburg 2006: 52-54 basalt), a minute sample (designated 1/113) was taken on the right side near the base and submitted for analysis.⁴

During the 1994-95 reconstruction of Ahu Tongariki 15 statues, all carved of Rano Raraku tuff, were repaired and re-erected. A stone core was removed from a *moai* head (designated 14-548-R05 in the EISP inventory) when a hole was drilled at the fracture zone of the neck to restore it to the torso (Cristino and Vargas 1998: 157, Fig. 9). This sample (designated 2/115) was used for comparative analysis.⁵

Petrographic analyses of thin-sections of these two stone samples were accomplished using incident and reflected light microscopy (Figure 1). Both samples displayed textures and mineralogy characteristic of the Rano Raraku tuff deposit, and are characterised as an unwelded sideromelane tuff with moderately low alteration to palagonite. Lapilli are predominantly vesicular with round or elongate vesicles in addition to prismatic glass shards, some with jigsaw cracking. The sideromelane matrix encloses plagioclase laths (~2%), augite (~1%) and small olivine phenocrysts with some alteration to iddingsite (1%). Opaques, only present in sample 2/115, were predominantly tabular and skeletal ilmenite (~1%) with associated magnetite.

The anorthite content of the plagioclase phenocrysts places sample 1/113 at 52 percent (An_{52}) and sample 2/115 at 54 percent (An_{54}). Both of these values fall within the chemistry of that which has been established for Rano Raraku tuff (An_{52} - An_{54}) (Baker 1993: 131). While also within parameters recorded for hawaiiite (An_{70} - An_{50})

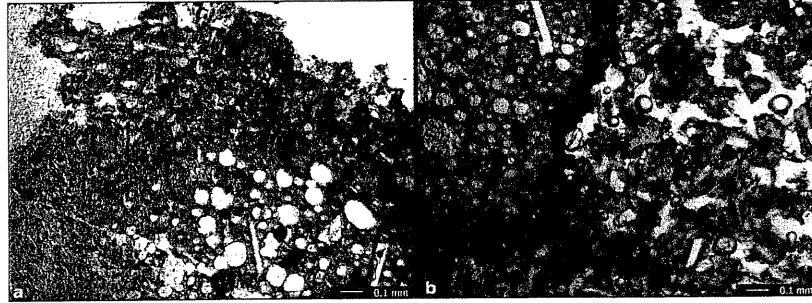


Figure 1. Thin-sections of moai stone material: (a) sample 1/113, and (b) sample 2/115.

(Déruelle *et al.* 2002: 54), these values are clearly of the plagioclase chemistry for all other rock types on Easter Island including the basalts and mugearites (Baker 1993, Baker and Buckley 1974).

In conclusion, both statues were carved in the Rano Raraku quarry. The National Museum of Natural History record is thus amplified, the number of authenticated sculptural objects in museum collections visually identified as carved of “basalt” is revised from 18 to 17, and the published record corrected. None of the other statues in the non-Rano Raraku subset has as yet undergone petrographic analyses, but an extended programme of sampling and analysis of statues and stone quarries is advocated. Such information is essential to (i) achieve exact sourcing of all non-Rano Raraku statues, and (ii) define individual quarry locations within precisely mapped Rano Raraku zones. Better understanding of labour investment and management in Rano Raraku and of secondary stone resource use as an alternate procurement strategy, are anticipated research results.

NOTES

1. Thomson 1891; NMNH Ethnology Catalog 128,368; SI-WDC-001 in EISP inventory; Ht 2.24m; Acc. No. 19025; c.3.34m tons.
2. Thomson (1891: Plate XXVIII) gives the site as “Anakena”; Barthel (1958: 259) points out this error and calls the site “Ahu A Pepe”.
3. NMNH Ethnology Catalog 128, 370; designated SI-WDC-002 in EISP inventory; Ht 1.19m); a *pukao* (128,369; designated SI-WDC-003 in EISP inventory; Van Tilburg 2006: 54, image 84) was also collected.
4. The sample was collected by J. Van Tilburg with Greta Hansen, Head Conservator, Department of Anthropology Conservation Laboratory, NMNH.
5. Thirty-nine well-documented rock samples in the Mark C. Bandy Easter Island Collection (100304), Department of Mineral Sciences, NMNH, Smithsonian Institution, form a baseline descriptive sample.

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