



# A collapsed narrative? Geochemistry and spatial distribution of basalt quarries and fine-grained artifacts reveal communal use of stone on Rapa Nui (Easter Island)



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## ABSTRACT

Many publications document Easter Island's famous *ahu* (platform), *moai* (statue), *pukao* (topknot), and almost millennium-long culture. Yet, little investigation has been dedicated to basalt resources, artifacts, and their geochemistry. As part of the Rapa Nui Geochemical Project (2014–2017), we conducted comprehensive fieldwork, material culture and archaeometric analyses focused on Easter Island's archaeological basalt industries. Our results highlight how the prehistoric Rapanui were sophisticated Polynesian stone workers who developed multiple tool reduction sequences for several types of basaltic material, creating unique anthropogenic landscapes in the process. Using laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) of geological source material from 31 quarries and 61 artifacts from the Sebastián Englert Anthropology Museum, we argue that similar to other culturally valuable stone (i.e. obsidian, scoria, and tuff), there was communal access to and use of Rapa Nui's basalt resources. In turn, prehistoric communal access to stone hints at patterns of sociopolitical and economic interaction, including cultural connectivity on this eastern Polynesian outpost. Thus, our empirically derived archaeological conclusion casts doubt on sociopolitical and economic interpretations proposed by Easter Island's collapse narrative.

## 1. Introduction

The earliest investigations conducted on Easter Island (Fig. 1) addressed the islander's mining operations that included the *moai* (statue) quarry at Rano Raraku and the *pukao* (topknot) quarry at Puna Pau (Englert, 1948, 1970; Geisler, 1882; Heyerdahl and Ferdon Jr., 1961; Métraux, 1940; Routledge, 1919; Thomson, 1891). Such large-scale undertakings at these megalithic quarrying sites highlight how mining for stone required an understanding of geology, a familiarity with engineering, and labor organization and specialization. Other raw materials exploited by the ancient Rapanui included obsidian from four sources (Motu Iti, Orito, Rano Kau, and Te Manavai), trachyte from Poike, *hani hani* (red scoria) from the Vai O'Hao and Puna Pau region, and *kie'a* (mineral pigment) from the island's rocky coasts (Arredondo, 2003; Beardsley and Goles, 1998, 2001; Beardsley et al., 1996; Hamilton, 2007, 2013; Hixon et al., 2017; Simpson Jr., 2014; Stevenson et al., 2013; Vargas et al., 2006). Yet, few archaeological investigations

have focused on how the prehistoric Rapanui obtained and worked fine- and coarse-grained basaltic material (see McCoy, 2014; Simpson Jr. et al., 2017 for similar discussion). Basalt was used to fabricate: 1) *keho* – flat laminates; 2) *paenga* – dressed vesicular blocks used in *ahu* (platform), *hare nui* (community house), *hare paenga* (elite home), *ana kionga* (refugee cave), and *umu* (stone slab-lined oven); 3) *pae* – non-dressed vesicular blocks used in *ahu*, *ana kionga*, *umu*, *hare vaka* (boat-shaped house), *hare oka* (circular house), *manavai* (rock-walled garden), *tupa* (observation tower), and *pipi horeko* (land marker); and 4) artifacts including *toki* (adze and pick), *kauteki* (composite adze), *ohio* (ax), *hoe* (knife), and *mangai mā'ea* (fishhook). Thus, there is an importance to better examine and understand the archaeological evidence for the acquisition and use of basalt, given the vast role that the stone played in many aspects of prehistoric life.

In a recent publication (Simpson Jr. et al., 2017), we reported archaeological site and archaeometric data using inductively coupled plasma–mass spectrometry (ICP-MS) from the adze quarry Rua

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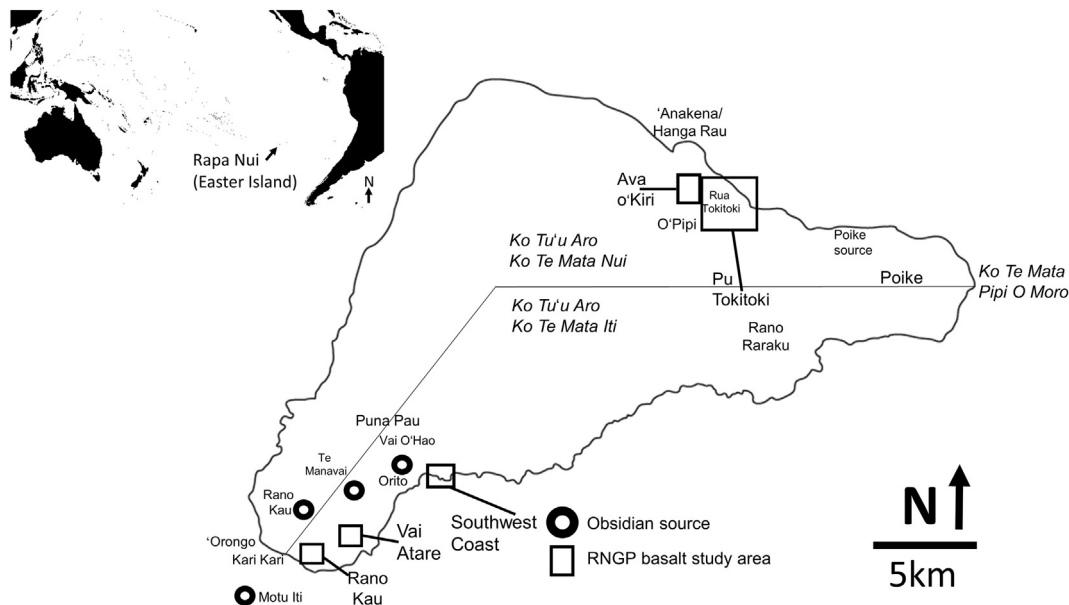


Fig. 1. Geographic location of Rapa Nui, stone quarries, and place names mentioned in the text.

Tokitoki and a fine-grained basalt source<sup>1</sup> on Poike (Fig. 1). This allowed for the development of a geochemical baseline to assign geological sources to archaeological samples. Similar to interpretations regarding *paenga* manufacture (McCoy, 2014), we concluded that the Rua Tokitoki quarry and the source on Poike exhibit evidence for the intensive manufacture and specialized production of basalt tools. Outcomes from Simpson Jr. et al. (2017), combined with results from this current Rapa Nui Geochemical Project (RNGP) report, can now be used to trace the movement of artifacts from geological sources to archaeological sites. In turn, this forms a basis to infer differential access to and use of basalt resources during Rapa Nui prehistory. In other words, a better understanding of how basalt raw materials and finished artifacts circulated through the ancient Rapa Nui society, will help to evaluate previous interpretations of economic and sociopolitical organization (Hotus and the Rapa Nui Council of Elders, 1988; Lee, 1992; Métraux, 1940; Routledge, 1919; Simpson Jr., 2008; Stevenson, 2002; Van Tilburg, 1994; Vargas et al., 2006). In this report, we: 1) describe 31 fine-grained basalt mines, quarries, sources, and workshops found within five study areas on Rapa Nui (Fig. 1); 2) report major, minor, and trace element compositions obtained from laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) for 117 geological basalt specimens from 31 RNGP sites and for 61 artifacts from 14 archaeological contexts; 3) discuss the implications of basalt distribution and use during Rapa Nui prehistory; and 4) refute sociopolitical and economic interpretations provided by the collapse narrative for Easter Island (Bahn and Flenley, 1992; Diamond, 2005).

## 2. Regional setting

### 2.1. Cultural context

Since European discovery of Rapa Nui in 1722, the island and its stone archaeological remains have attracted international attention. Most researchers have studied the numerous *moai* (Shepardson, 2013; Van Tilburg, 1994; Vargas et al., 2006), *pukao* (Hamilton, 2007, 2013; Hixon et al., 2017; Martinsson-Wallin, 1994; Thomas, 2014), and *ahu*

<sup>1</sup> We use the term 'source/quarry' as only a few stone locales on Rapa Nui are actual 'quarries' defined by the presence of extraction pits, while other locales are more properly called 'sources' as tool-quality stone or construction materials were merely collected from the surface (after Weisler and Sinton, 1997:180).

(platforms) that have been inferred to serve ideological purposes, represent aspects of sociopolitical organization and economy, and used in the demarking of elite visual-scapes (Beardsley, 1990; Martinsson-Wallin, 1994; Simpson Jr., 2009; Stevenson, 2002). The construction of these megalithic features was thought to represent the manifestation of ancient Polynesian ancestor worship, to ensure fertile harvests and successful fishing campaigns, and to enforce resource and land ownership rights (Earle, 1997, 2002; Earle and Spriggs, 2015; Emory, 1943; Firth, 1967; Graves and Sweeny, 1993; Kirch, 1984, 1990, 2000; Kolb, 1991, 1994; Simpson Jr., 2008, 2009). This latter point is of importance, because unlike the multiple islands and vast valleys and peaks of the Marquesas, Hawaii, and Tahiti, Rapa Nui's isolation, along with its broad gently rising plains, prescribed a cultural system which directly demarcated land, resources, and inhabitants. According to the oral tradition and ethnolinguistic and ethnographic sources (Englert, 1948, 1970; Hotus and the Rapa Nui Council of Elders, 1988; Métraux, 1940; Routledge, 1919), the island's first chief, Hotu Matu'a, divided the island among each of his six sons, forming the first *mata* (clans) and *mata kainga* or land divisions. But, by European colonization, the island was divided into 11–18 *mata*, with two major confederations forming, *Ko Tu'u Aro Ko Te Mata Nui* (high-status northern clans) and *Ko Tu'u Hotu Iti Ko Te Mata Iti* (low-status southern clans), which are divided by the *Ko Te Mata Pipi O Moro* line (Hotus and the Rapa Nui Council of Elders, 1988; Vargas et al., 2006; Fig. 1). As such, each Rapanui *mata* was afforded access to coastal and inland resources (Stevenson, 2002), like in *ahupua'a* organization in Hawaii (Handy and Pukui, 1989; Kirch, 1984). However, control over staple- (horticultural crops) and luxury- (pelagic fish, dolphins, turtles, lobsters, and eels) resources was mostly reserved for the elite of Rapa Nui (Englert, 1948; Métraux, 1940). This included the *Miru* (the most ranking *mata*), *ariki mau* (paramount chief), and *ariki paka* (secondary chiefs) found at Hanga Rau ('Anakena), along with *tangata honui* (local chiefs and elite) who held position over *ure* (family lineages) and inhabitants of each *mata* throughout the island (Sahlins, 1958; Simpson Jr., 2008; Stevenson, 2002). Using elite architecture, first-fruit ceremonies, and corporate work strategies, elite Rapanui oversaw and controlled the political economy, and rechanneled labor to invest in landesque capital intensifications (Kirch, 1990) such as *ahu* and *moai*, which ultimately legitimized and broadcasted *Miru* and *tangata honui* control over *mata kainga*, *mata* inhabitants living inland (commoners), and the staple-resource economy (Howard, 2007; McCoy, 2014; Simpson Jr., 2008, 2009; Simpson Jr.

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