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Origins of Epipalaeolithic obsidian artifacts from Garrod's excavations at Zarzi cave in the Zagros foothills of Iraq

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ABSTRACT

Ninety years ago in the Zagros foothills of Iraq, Dorothy Garrod and her team excavated Zarzi cave, the type site of the Epipalaeolithic "Zarzian" lithic industry. Garrod reported the existence of "two small fragments of obsidian" in the principally chert-based microlithic assemblage. One of the two artifacts from Zarzi was analyzed by Renfrew and colleagues in a pioneering application of obsidian sourcing to the Near East, which elucidated links between Neolithic villages. It was, unfortunately, ambiguously assigned to their "Group 4c" obsidian, which occurs at two different sources, ~120 km apart, in eastern Turkey. New interpretive methods — agent-based models, least-cost path analysis, and others — have been applied to the datasets of Renfrew and colleagues, furthering work on the mechanisms of Neolithicization. With respect to the Epipalaeolithic, though, all of these studies rely entirely on this single Zarzi artifact with an inconclusive attribution. Fortunately, the second Zarzi obsidian "fragment" — a burin spall — was "rediscovered" at the Peabody Museum of Archaeology and Ethnology at Harvard. Our study establishes that both artifacts came from Nemrut Dağ volcano, 400 km linearly and ≳650 km on foot. To do so, multivariate analyses were applied to the original spectroscopic data of Renfrew and colleagues, while state-of-the-art portable XRF was used to source the burin spall at Harvard's Peabody Museum. Comparison to two Epipalaeolithic sites in the Caucasus begins to reveal a patchwork of interaction spheres that highlight not only the potential of obsidian sourcing but also the considerable amount of work yet to be done.

1. Introduction

In the Mesopotamian highlands, the Epipalaeolithic (EP) — that is, the portion of the Upper Palaeolithic that falls between the Last Glacial Maximum (LGM, 26.5 to ~20 ka) and the start of the Neolithic (12 ka) — is a crucial period for investigating the rise of food production, sedentism, and other aspects of the so-called "Neolithic package." This timeframe is even considered "Period 0" in the *Atlas des Sites du Proche-Orient* (ASPO) chronological scheme, devised by the Maison de l'Orient et de la Méditerranée, as a means to conceptualize the rise of Neolithic phenomena that culminated in urbanism (Hours et al., 1994; Aurenche et al., 2001). A variety of stimuli have been proposed for this "revolution" that appears, at least, to coincide with the beginning of the Holocene (~11.65 ka). Braidwood's (1951) "hilly flanks" hypothesis posited that agriculture and sedentism arose in the foothills of the Taurus and Zagros mountain ranges, where fertile land enabled grain gathering and which coincided with the natural habitats for the wild forms of domesticates. Binford (1968) and Flannery (1969), in response to Braidwood, held that demographic pressures drove a shift to food production. Hayden (1992) suggested that feasting and other opulent displays drove agriculture. Individuals who could amass a food surplus were able to transform it into, for example, exotic and desirable objects, facilitating the rise of social inequality. Price and Bar-Yosef (2011) point out that each of these scenarios is "very much a chicken-egg question, like the issue of population pressure, of which came first" (S167). There is, though, an increasing recognition that certain aspects of the "Neolithic" package may have emerged at different times and places during the EP (e.g., Akkermans, 2004; Watkins, 2010; Weide et al., 2018). Consequently, "Period 0" is an important time in which to seek archaeological evidence that can be contrasted against Neolithic datasets.

Over the past five decades, obsidian artifact sourcing has played a

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vital role in revealing the interconnectedness of Neolithic communities across Mesopotamia. Renfrew et al. (1965) pioneered obsidian sourcing to investigate development of the Minoan state and Mycenaean Greece and their roles in Bronze Age exchange systems throughout the Aegean. Their technique was soon applied to the Neolithic revolution in the Near East (Renfrew et al., 1966, 1968). Of great interest at this time was how farming spread between villages, which were typically thought to have been fairly isolated during the early Neolithic. The spread of obsidian, however, showed that the settlements were not isolated and hinted that, as material moved, so too could have innovations. Specifically, Dixon et al. (1968) interpreted the resulting distribution patterns (i.e., "fall-off curves") as evidence for "down-the-line" trade, in which obsidian moved among communities via a chain of interactions. Obsidian, they argued, can serve as an indicator of contacts between different Neolithic groups and might, in turn, define the type of their interactions. More recently, new interpretive methods — agent-based models and complex systems theory (Ortega et al., 2014, 2016; Ibáñez et al., 2015), least-cost path analysis (Barge et al., 2018), and network analysis (Batist, 2014) — have been applied to the data of Renfrew et al. (1966, 1968) and subsequent studies (see Cauvin and Chataigner, 1998; Batist, 2014; Moutsiou, 2014) to elucidate the mechanisms of Neolithicization. With respect to the EP, each of these studies relies on just one sourced — and ambiguously attributed — obsidian blade excavated from Zarzi cave in the Zagros foothills of the Kurdistan region of northern Iraq.

In 1928, immediately following her excavations at Gibraltar and ten years before she became the Disney Professor of Archaeology at the University of Cambridge (Caton-Thompson, 1969; Davies, 1999), Dorothy Garrod led an expedition to Iraqi Kurdistan, jointly funded by the Percy Sladen Memorial Fund of the Linnaean Society of London and the American School of Prehistoric Research (ASPR). Garrod's team included Charlotte A. Baynes and two ASPR representatives, Robert A. Franks, Jr. and Francis Turville-Petre (Garrod, 1930). Baynes and particularly Turville-Petre had experience in western Asia (Bar-Yosef and Callander, 1997), both having excavated Emireh and Zuttiyeh Caves in what is now Israel in 1925–1926 (Turville-Petre, 1927). Franks was a former ASPR field school student (Bricker, 2002), and based on archival data at the Peabody Museum of Archaeology and Ethnology (PMAE) at Harvard University, he played an important role as manager of ASPR funds in the field (PMAE 2015.0.32, ASPR records, Box 1, Folder 4; PMAE 995-3, George Grant MacCurdy photographic records, Box 8). The project's receipts and accounting data (PMAE 2015.0.32, ASPR records, Box 1, Folder 4) graphically, and depressingly, chronicle Turville-Petre's well-documented (Bar-Yosef and Callander, 1997) extreme levels of alcohol consumption. Garrod and her team excavated at Zarzi cave for nine days and the Hazar Merd caves for seventeen days. A follow-up excavation to complete the work at Hazar Merd and to conduct and expanded survey based around Halabja to the south was apparently planned for 1931 but canceled when the local antiquities department denied a research permit due to political instability (PMAE 2015.0.32, ASPR records, Box 1, Folder 4). By this time, Garrod and Turville-Petre were focused on excavations at Kebara and subsequently the multiple sites at the Wadi Mughara (Bar-Yosef and Callander, 1997; Garrod and Bate, 1937), and they never returned to Iraqi Kurdistan.

At Zarzi, Garrod and her team encountered a stratigraphic horizon, Layer B, with microlithic artifacts. These artifacts composed "a typical Upper Aurignacian *ensemble*" that corresponded to "the final stage of the Upper Palaeolithic" (Garrod, 1930:22). Cherts were the most abundant lithic raw material, and she concluded that these cherts were primarily acquired as river cobbles because many of the cores retained weathered exterior surfaces. In total, she and her team recovered 648 complete or fragmented tools, nearly two thirds of which were notched blades (29.3%) and scrapers (34.7%). Garrod (1930) briefly mentioned that, among the lithic artifacts, "two small fragments of obsidian were found" (16). She did not elaborate, and as noted by Wahida (1981), Garrod's notebooks for the site have gone missing over the decades. The Zarzi collections were dispersed among multiple institutions, including the Cambridge Museum of Archaeology and Anthropology (CMAA) in the UK (accession numbers 1930-7-19). In the US, collections were shipped to institutions with strong connections to the ASPR, notably the PMAE (accession number 35-32-60), the Peabody Museum of Natural History at Yale University (accession number YPM ANT 014376), and the Smithsonian Institution's National Museum of Natural History (Petraglia and Potts, 2004). After the excavations at Zarzi and Hazar Merd in 1928, the collaboration between Garrod and the ASPR continued the following year with ASPR co-funding the ground-breaking Palaeolithic research at Tabun, el-Wad, and Skhul in the Wadi el-Mughara (Garrod and Bate, 1937).

One of the two Zarzi obsidian artifacts reappears in the literature in Renfrew and colleagues' application of obsidian sourcing to the Near East (Renfrew et al., 1966). Rather than simply being a "fragment," Renfrew et al. (1966) list the Zarzi artifact as a blade, and it was one of 132 obsidian artifacts from 42 sites included in the study. It was also one of six artifacts contributed by the CMAA. The analyses, for which Renfrew and colleagues settled on optical emission spectroscopy (OES), were conducted in Cambridge's Department of Mineralogy and Petrology. Unfortunately, OES is partly destructive, necessitating specimens of ~100 mg in the form of fine powder (Renfrew et al., 1965). It is uncertain how much of the artifact may have been taken as a sample, but the CMAA catalog lists only "a chip of obsidian" among microliths (e.g., crescents, triangles, and backed pieces) from Zarzi. Renfrew et al. (1966) attributed the blade to their "Group 4c," which included the obsidian from two sources in eastern Turkey: Nemrut Dağ volcano and a source near the city of Bingöl, which came to be known as the "Bingöl A" obsidian source (Cauvin et al., 1986). After the discovery of the latter, Renfrew et al. (1968) noted that Nemrut Dağ and Bingöl A obsidian are "difficult to distinguish… At present, therefore, obsidian of Group 4c may derive from either of these sources" (320). This had no effect on their large-scale reconstruction of Neolithic obsidian distribution (Fig. 1a). This ambiguity, however, is considerable when efforts to create high-resolution reconstructions remain predicated on this blade as the only sourced EP artifact (Fig. 1b; Barge et al., 2018). That is, this blade, despite its inconclusive origin, has, until now, remained the sole datum for "Period 0" in Mesopotamia.

The other Zarzi obsidian artifact basically disappeared from the literature. It was recently "rediscovered" at Harvard's PMAE during a search of their collections for Aurignacian materials to build a teaching collection. It turned up during this search because Garrod's original attribution of "upper Aurignacian" has been retained in the PMAE records database. The artifact — a burin spall — is one of 78 lithic tools and cores from Zarzi at the PMAE, that is, ~12% of Garrod's excavated assemblage. A search through the museum's associated accession file (35-32) suggested how the Zarzi lithic artifacts arrived in their collection. In May of 1935, ASPR transferred > 700 artifacts, recovered from their excavations at various sites across Europe and the Near East, from the University of Pennsylvania's Museum of Archaeology and Anthropology to the PMAE. George MacCurdy, Director of ASPR, wrote to Donald Scott, Director of the PMAE, on May 15, 1935 regarding this loan. MacCurdy wrote that he was looking forward to seeing the collection on exhibit at the PMAE, and he also mentioned: "When we come [to visit], I shall bring along a proposition just received from Dorothy Garrod" (PMAE File 35-32). Garrod's proposition is likely how this set of Zarzi artifacts (as well as a number of lithics from her Hazar Merd excavations) came to the PMAE, where they have been ever since.

Our study establishes the origin of both obsidian artifacts excavated 90 years ago by Dorothy Garrod and her team. Multivariate analyses are employed as a means to clarify the volcanic source of the blade at the CMAA, while state-of-the-art portable X-ray fluorescence (pXRF) has revealed the source of the burin spall at the PMAE. The obsidian for both artifacts came from Nemrut Dağ volcano in eastern Turkey, ~400 km linearly and ≳650 km on foot from the cave, which is the type site of the "Zarzian" industry. These results offer a sharper insight into