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Diversity in obsidian use in the prehistoric and early historic Middle East

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ABSTRACT

The presence of obsidian in the Near East has always evoked a response about its exotic nature and origins. It was not until 1960s, however, that this was put onto a scientific footing when Colin Renfrew and his collaborators began to explore obsidian in Turkey and the Mediterranean. Their characterisation of the sources allowed them to attribute artefacts to different sources and suggest models of dispersal and distribution. Since then considerably more artefacts have been attributed to sources, although mostly only small numbers from individual sites. This has led to various interpretations of how obsidian was obtained and used; new studies have considered least cost path analysis, network analysis and agent based modelling. Increasingly, new methods of provenancing of artefacts have also meant that large number of artefacts can be analysed relatively speedily and efficiently. Portable instruments allow data to be collected outside laboratories, avoiding restrictions imposed by export licenses or simplifying work on museum collections. Here we employ richness and diversity indexes to elucidate some of the patterns in obsidian source use and argue that there are several reasons why the provenancing of large proportions of assemblages will be critical in exploiting the true potential of obsidian studies in the Near East, even though the initial haphazard, small sample approach has been quite effective in sketching out the big picture.

1. Introduction

In the Middle East, obsidian only occurs naturally in certain regions but it was widely used to make tools from early prehistoric periods. In the earlier Palaeolithic, that use was only near to source (Kuhn et al., 2015; Yalçınkaya, 1998) but, ca. 40,000 years ago, it began to be acquired by people far from the sources, something which intensified through time (Frahm and Hauck, 2017). As a raw material, it is sufficiently distinctive in appearance to be easily recognized as an exotic material so is likely to have been as attractive to prehistoric peoples as to modern archaeologists, albeit for different reasons. For archaeologists, the possibility of being able to match the obsidian used to make tools to its geological source offers many interpretative possibilities, including exchange systems, social networks and symbolic meanings. We should remember, too, that prehistoric people might have been, at least on some occasions, aware of the distant origin of the material they exploited and this may also have been an influence on the way that its meaning was constructed (Maeda, 2003, 2009: 144, 150, 153, 2013: 269ff.; Carter et al., 2013).

Our understanding of which sources were important depends almost entirely on artefacts which have been provenanced from excavated sites which are mostly far from the sources. There is very little evidence for occupation at the sources themselves after the Middle Palaeolithic, apart from some workshops and campsites on the Göllüdağ source (Balkan-Atlı et al., 2013: 468).

The most systematic overview remains that of Christine Chataigner (1998), which built on and consolidated Renfrew et al.'s (1966, 1968) work, even though much more obsidian has now been analysed. It indicated that a very high proportion of the obsidian provenanced comes from three compositionally distinct sources, namely Göllüdağ East, the peralkaline sources of Nemrut Dağ/Bingöl A (which although 150 km apart have proved difficult to distinguish compositionally) and the calcalkaline source at Bingöl B with other sources playing a lesser, and sometimes very minor, role. While Nemrut Dağ and Bingöl A are now generally distinguishable (Chataigner, 1994; Frahm, 2012a; Carter et al., 2013), the essential pattern remains the same, with a very limited set of sources apparently dominating the supply of obsidian. However, as

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Chataigner herself pointed out (1998: 322), this overview was based on a small number of artefacts from each assemblage relative to the numbers excavated so it probably underestimated the number of secondary sources present. It is also a picture that has often been based around the site as the primary unit of analysis, when most sites have long periods of occupation and potential variation in specific phases and sub-contexts (already implicit in the phasing in the tables in Chataigner, 1998). Now, however, advances in analytical techniques (e.g., Poupeau et al., 2007; Carter, 2014; Forster and Grave, 2012; Frahm, 2013) make it increasingly feasible to provenance many artefacts from single assemblages (or even entire assemblages) and to link techno-morphological attributes to provenance data in a way that has hitherto not been possible (e.g., Maeda, 2013; Carter et al., 2013; Milić, 2014; Campbell and Healey, 2016). This starts to change our approach to understanding obsidian use in the past.

2. Background to this study

2.1. The sources

The geological occurrences of obsidian in the Middle East that are of particular importance in this article are concentrated in three main regions: central Anatolia, south-east Anatolia, and north-east Anatolia, Armenia and Georgia (Fig. 1). The large majority of obsidian found in Mesopotamia and the Levant originates from sources in mountainous regions of central Anatolia and south-east Anatolia. Obsidian from sources further afield to the north and east is only rarely present. While geological sources of obsidian can also be found in the south-west of the Arabian Peninsula and East Africa, and in the north-west Anatolian, Mediterranean and Carpathian regions, the use of these sources of obsidian is not documented in most of the Middle East.

Behind this apparently straightforward picture, the reality is much more complex. Our knowledge of specific source areas is still quite variable. Recent geological and geophysical surveys of Göllüda ğ (Binder et al., 2011), Nemrut Dağ (Robin et al., 2015, 2016), north-east Anatolia (Chataigner and Gratuze, 2014a, 2014b; see http://geobs.univ-rouen.fr/; Akköprü et al., 2017), Meydan Dağ and elsewhere by the McMaster Obsidian Procurement Expedition (see https://maxlab.mcmaster.ca/research-projects/mcmaster-obsidian-procurement-expedition-mope), as well as Biagi and Gratuze's survey of Paravani/Chikiani in Georgia (Biagi and Gratuze, 2016), demonstrate that the physical availability of obsidian as well as its elemental composition is often considerably more complicated than initially appreciated (cf., Shackley, 2008; Poupeau et al., 2005; Binder et al., 2011; Robin et al., 2016). In many cases, it is clear that the locations from which people obtained obsidian in the past were the geological outcrops themselves, as the quarry workshops at the Göllüdağ source indicate (Binder et al., 2011), but in other cases obsidian was probably mainly obtained from secondary sources such as river beds.

2.2. Source characterisation and geo-referenced data sets

As our knowledge of the complexity of the sources increases, successful attribution of artefacts to source obviously depends on the availability of an up-to-date and comprehensive geo-referenced library. In the main, the most used sources are better documented and are represented in most reference collections of source material. In some cases, the compositions of the major sources are very distinctive and can be identified with reasonable certainty from published data. For example, Bingöl B does not overlap with other compositional groups across many elements, while the peralkaline obsidians of Bingöl A and Nemrut Dağ cannot easily be confused with other sources. In other cases, the distinction can be more problematic. The composition of Göllüdağ East obsidian is less easily distinguished from obsidian from Armenian sources such as Syunik, unless the analyst has access to source material from both areas. In the Levant and Mesopotamia, this may appear to be a peripheral problem, as Göllüdağ East is very common and Armenian obsidian extremely rare in prehistory but, as discussed below, in later Mesopotamia at least, Syunik does become significant as a source. When it is important to understand less common sources, it becomes significant that they are both less well represented in reference collections and also less well documented in publications. This situation is gradually changing, with detailed studies of new obsidian source areas noted above, but progress remains slow and patchy. Attribution of artefacts to particular sources from older publications sometimes remains problematic, with misattributions to sources that were inadequately understood (e.g., Frahm et al., 2016) or the attribution of artefacts to, at the time, unknown sources. Unfortunately changes in techniques and limited use of international standards can make it difficult to solve these problems in retrospect. At the same time, obsidian source analysis is becoming more accessible, especially through the widespread use of portable X-ray Fluorescence (pXRF) instruments. While this brings many advantages (e.g., Frahm, 2013; Frahm et al., 2014), without empirical calibration to standards it can be easy to generate poor quality results that rely too heavily on published source data rather than using a comprehensive source data set analysed with the same instrumental setup (Nazaroff et al., 2010; Speakman and Shackley, 2013; Wilke, 2017). While attributions to the more common sources are overwhelmingly reliable, in both legacy data and some recent studies, artefacts from the less common sources may be under-represented, which will impact our interpretation of the use of minor sources.

2.3. Access to the sources and obsidian acquisition

The mechanisms of the dispersal of obsidian from the sources has been a topic of discussion since Renfrew's seminal work in the 1960s and 1970s (Renfrew et al., 1968; Renfrew, 1975, 1977a). He modelled distribution on the basis of quantity and distance from source, and his supply and fall-off zones still provide the vocabulary for many discussions of obsidian exchange. While some elements of Renfrew's model still remain valid, despite the limited data, where studies have considered the form in which the obsidian reached a site and how it was worked, a more nuanced picture emerges. At Çatalhöyük, for example, two different modes have been noted, one in which quarry flakes were collected from no longer active workshops on Göllüdağ and taken back to site for working; the other in which obsidian from active workshops was reduced at the workshop prior to export (Carter and Milić, 2013a, 2013b). So too at Körtik Tepe in the Upper Tigris region, between 125 and 140 km from the nearest sources, the obsidian from Nemrut Dağ and Bingöl A was acquired as unmodified nodules, whereas that from Bingöl B was partly prepared before 'export' to Körtik Tepe (Carter et al., 2013: 561). Later at Tell Hamoukar, in northern Syria, unworked nodules from the Bingöl source area were present along with a full *chaîne opératoire* relating to blade production suggested direct access to the source (Khalidi et al., 2009: 891). In the case of a parcel of blades found at Tell Sabi Abyad, some 300 km distant from the source, Laurence Astruc et al. (2007) have offered two models of acquisition and dispersal, both based on direct access to the source but with different ways of reaching the end location.

Other approaches have used formal modelling. One, in Armenia where multiple sources are potentially accessible, used travel costs and isochrones around the source with least cost path analysis to investigate potential routeways and the time needed to reach them.

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