

# **Origin of Obsidian Tools from Ubaid and Rick Abad in Little Zab Basin, Northwestern Iran**

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## **Abstract**

Decades of obsidian provenance studies have been conducted in different areas in northwestern Iran. Unlike other parts of northwestern Iran, there have been no obsidian studies in the Little Zab basin. Despite the importance of this basin, only a limited number of excavations and archeological studies in this area have been conducted. The artifacts in the present study came from Rick Abad and Ubaid, sites along the Iran-Iraq border. All of the artifacts were discovered to be from sources in Turkey and none from Armenia. It seems that the cultural transformation taking place in the Little Zab basin had almost no effect on the interaction areas and exchange routes in the western part of Lake Urmia which connected to Anatolia, or the roads extending westward into Iraqi Kurdistan and northern Mesopotamia.

**Key words:** obsidian, northwestern Iran, Little Zab basin, Meydan Dağ, Nemrut Dağ

## **Introduction**

Northwestern Iran, with its favorable climate and proximity to Anatolia, Mesopotamia, and Naxcivan holds significant archaeological importance during numerous prehistoric and historical periods. Also, located nearby in the northwestern Iranian plateau is the Urmia Lake basin, which surrounds the approximately 5200 square kilometer Lake of Urmia.

Unlike the surrounding area, no archaeological evidence has been found for the socio-cultural sequences during the pre-pottery Neolithic (PPN) in the Urmia Lake basin. The Urmia Lake basin did not have favorable conditions for habitation until the seventh millennium B.C. because of the arid and cool climate of the region (Ajourloo, 2013:38). Climate changes that occurred after that, provided the possibility for the earliest Neolithic settlements such as Hajji

Firuz (Voigt, 1983), Yanik Tepe (Burney, 1964), Jolbar (Razaqi and Fahemi, 1996), Ahranjan (Talai, 1983) and Qara Tepe. The other side of Zagros in upper Mesopotamia reported early settlements, but in northwestern Iran it is doubtful that such sites can be found (Binandeh, 2019).

The chronological framework for Urmia Lake basin stems from Dyson's pioneer survey and excavation work carried out in the middle of the previous century on the Solduz plain (Dyson and Young, 1960). The cultural sequence for northwestern Iran, especially south of Urmia Lake basin, is based on the series of dates from other excavated sites. The prehistoric sequences of this area are based on excavations at Hasanlu, Hajji Firoz (Voight, 1983), Dalma Tepe (Hamlin, 1975), Pisdeli (Dyson and Young, 1960), Goy Tepe (Burton Brown, 1951) Dinkha and Se Girdan (Dyson et al., 1969), which were almost all carried out by Hasanlu's team. In general, the earliest traces of human settlement in the region date to the Paleolithic, and include caves and open-air sites south and west of Lake Urmia. Shiawatoo near Qaziabad in Mahabad belonged to lower Paleolithic (Jaubert et al., 2004), and Tamtaman, which is located near Urmia, belonged to newer Paleolithic periods (Coon, 1951).

In the early Chalcolithic period, Dalma pottery is characteristic of period IX in the main sequence at Hasanlu Tepe. Dalma pottery has been found in other sites in the Solduz valley and closely similar pottery was excavated at Tepe Seavan (Solecki-Solecki, 1973) in the Margavar valley west of Urmia. Recent decades of archaeological work resulted in the identification of more sites from this period.

The Zab River basin consists of Piranshehr and Sardasht in Iran's West Azerbaijan province and parts of Baneh in Kurdistan province. The Zab River rises from the northwestern highlands of Piranshehr and joins different branches while passing through the highlands of Alan before entering Iraq. In this region, there are many water sources.

The Haji Omran pass in the north and the Alan pass in the south lead from Piranshahr and Sardasht west through the Zagros Mountains into Iraqi Kurdistan and northern Mesopotamia. The length of this basin represents a relatively vertical strip along the international Iran-Iraq border, and the Little Zab River encounters longitudinal and latitudinal expansions from northwest-to-southeast and east-to-west directions (Khezri, 2000). The Zab basin is located in an area with a cold and temperate mountainous climate as well as Mediterranean rainfall, with an average annual temperature between 11.7–13.3°C and an annual rainfall of about 700 ml.

In 2012, the Iranian government decided to build a number of dams at the southern and northern ends of the Zab Basin. The dams would create a large artificial lake, and this would flood some 20 ancient sites. Rick Abad and Ubaid are two of the sites that will be flooded (Fig. 1).

## Archaeological sites

Rick Abad Tepe is located north of the Zab River. This Tepe (hill) is about 3.5 hectares in area and 7.5 m in height; it is situated 10 km southeast of Piranshahr. In the past the size of this Tepe was larger, but the northern area of the Tepe was destroyed during recent development projects by villagers. The surface findings of a preliminary survey show the site had been used in the Chalcolithic period and Iron Age. The Ushnu-Solduz valley is separated from this region by small hills. The Tamarchin passage west of Piranshahr connects this region to northern Mesopotamia. Excavations on the site were conducted by A. Binandeh. The first field season of excavations was carried out from August to September, 2019. Based on preliminary studies and potsherds from two trenches (Fig. 2), the site was occupied in the Islamic, Iron Age, Bronze Age and Chalcolithic periods. The obsidian obtained from trench B belonged to the late Chalcolithic period.

Another site, Ubaid, was excavated in 2018. This site extends about 0.5 hectare and is located in the foothills near the little Zab River. Rick Abad and Ubaid are located less than two kilometers apart (Fig. 3). Three trenches were excavated at this site. Based on the pottery sherds, this site belonged to the early Chalcolithic period (Dalma), and it was a pastoralism temporary settlement.

More Chalcolithic sites less than 2 hectares exist. The sites north of the basin in the small valleys and plains between the mountains are more linear in shape and sub-branches of Zab are more considered. In addition to animal-husbandry, they developed agriculture as well.

## Chalcolithic Settlements of little Zab

Based on surface surveys, more than 20 archaeological sites from the Chalcolithic period have been identified in the basin. Among them, two sites were excavated. Lavin Tepe is about 1.5 hectares in area and 15 m in height, and it is situated 4 km east of Piranshahr. The excavation in 2011 resulted in identification of seven periods. The longest period of settlement in Lavin belongs to the Chalcolithic period (Nobari et al., 2012). A second site that was salvage excavated in recent years, Silveh, is close to Piranshahr city. The period of occupation at the

site began as early as the Chalcolithic period—Dalma to the Islamic period (Abedi and Ebrahemi, 2018; 244).

## **Obsidian studies**

There are decades of obsidian studies from in different areas in northwestern Iran. The Western Neolithic sites contributed to early work in this field of research (Renfrew, 1969, 1977). In the past decade, obsidian provenance studies have also been carried out on several sites in central Zagros (Darabi and Glascock, 2013; Zeidi and Conard 2013). In northwestern Iran, there have been many publications from studies from the Hasanlu team and concurrent excavations around Urmia Lake at prehistoric sites (Renfrew et al., 1966; Burney 1964; Mahdavi and Bovington 1972).

In recent years, there have been several studies on obsidian artifacts from related sites in northwestern Iran and around Urmia Lake focusing on understanding exchange and provenance (Agha-Aligol et al., 2015; Khademi et al., 2007; Ghorabi et al., 2008; Ghorabi et al., 2010; Niknami et al., 2010; Noori et al., 2013 Khazaee et al., 2011; Khademi et al., 2013; Maziar and Glascock 2017; Abedi, et al., 2018). These works indicate that obsidian sources located in Armenia and Turkey are responsible for almost all artifacts recovered from sites in western and northwestern Iran (Fig. 4). Unlike other parts of northwestern Iran, there have been no related obsidian studies in the Little Zab basin. Despite the importance of this basin, unfortunately only a limited number of excavations and archeological studies in this area have been conducted. In recent years, excavations and surveys have taken place at multiple sites in the little Zab basin thanks to archaeological projects related to dam building.

The artifacts in the present study came from sites along the Iraq-Iran border. The sites are Rick Abad (n=2), and Ubiad (n=5). By comparing the chemical compositions of the artifacts to the compositions of known obsidian sources in Armenia and Turkey, it was possible to determine the origin for every artifact.

## **Sample Preparation and Analysis**

The artifact samples were analyzed for composition using a Thermo Quantx ARL spectrometer operating at 35kV. The samples were exposed to X-rays for 60 seconds each to measure the following elements: K, Ca, Ti, Mn, Fe, Zn, Rb, Sr, Y, Zr, Nb, and Th. The spectrometer was calibrated for obsidian studies by analyzing a suite of 40 geological obsidians

previously analyzed by NAA, XRF and inductively coupled plasma mass spectrometry (Glascock and Ferguson, 2012).

## Discussion

The results for the seven artifacts are listed in Table 1 along with source assignments. Fig. 5 shows a scatterplot of Rb versus Zr for the artifacts projected against 90% confidence ellipses for three major sources previously known to supply most of the obsidian to sites in Iran. Note that due to the variations in sample size and thickness, tiny artifacts will sometimes appear outside the confidence ellipses but along correlation lines. Even so, the source assignments are still secure as explained in works by Hughes (2010).

As shown in Table 1, all of the artifacts were found to be from Turkey and none from Armenia. One artifact, AB-07, was determined to be from the Meydan Dağ source in Turkey. And the remaining six artifacts were found to be from the Nemrut Dağ source.

Our obsidian samples from Ubiad belongs to the early Chalcolithic (Dalma), and Lavin belong to the late Chalcolithic/early Bronze. The Dalma culture was contemporaneous with Ubaid 3 (Voigt and Dyson 1992, pp. 158, 175), which slightly overlapped with the Early Northern Ubaid. Dalma Ware can be dated to the first half and middle of the fifth millennium B.C. In the Zab basin, most Dalma settlements are small—typically less than one hectare. Settlement patterns and site size does not coincide with the social stratification, tangible political, economic, or religious organization in this area. The widespread and abnormal geographical dispersion of Dalma pottery west of Iran, in central and northern Zagros, east of Iraq and Azarbijan argues that nomads were a considerable factor in the dispersion of this pottery (Hole 1987).

In the late third millennium B.C., the river basin contained a large number of ancient settlements. Based on pottery sherds, it has been inhabited from the prehistoric period to the present. Evidence of pottery from the late Uruk period, approximately late fourth millennium B.C., can be found in the Little Zab basin. During this time period we see social complexity accelerating in the Middle East. Geographical position and settlement patterns, signs of commercial and cultural relations of the North-Western Iran Society and northern Mesopotamia are evident in the late Chalcolithic (Binandeh, 2016). The late Chalcolithic settlements in northwestern Iran change during the following Early Transcaucasia period. In the Little Zab basin, Kura Araxes pottery is scarce, but Painted Orange Ware from this period can be seen. Some sherds show close resemblance in decoration style, albeit not in fabric, with the so-called Hasan Ali Ware found southwest of Lake Urmia.

Moreover, these settlements controlled access into northern Mesopotamia. These sites are situated at the end of the roads extending west into Iraqi Kurdistan, and have a role in controlling the mountain roads. Probably, these sites are connective points of a trade network. Data discovered from ancient sites show that there were close relations between this region and northern Mesopotamia and Anatolia. The Haji Omran and Kel-e-Shin passage to the west connects this region to northern Mesopotamia. In the Chalcolithic period, connections between this region and eastern Anatolia via Erzrum was also possible. These connections were a significant influence on the type and change of prehistoric culture (Binandeh, 2018).

## Conclusion

The analyses of obsidian collected from two different sites and chronological periods show that the seven artifacts in this study came from two well-known obsidian sources (Meydan Dağ and Nemrut Dağ) located in Turkey.

Tepe Ubiad is the only site that has connections with two geological sources Meydan Dağ and Nemrut Dağ from Anatolia. Rick Abad obtained obsidian from Nemrut Dağ only. The proposed model for exchange of this raw material is the same in different periods. It seems that the cultural transformations taking place in Little Zab basin had almost no effect on the interaction areas and exchange routes in the west part of Lake Urmia which connected to Anatolia, or the roads extending west into Iraqi Kurdistan and northern Mesopotamia.

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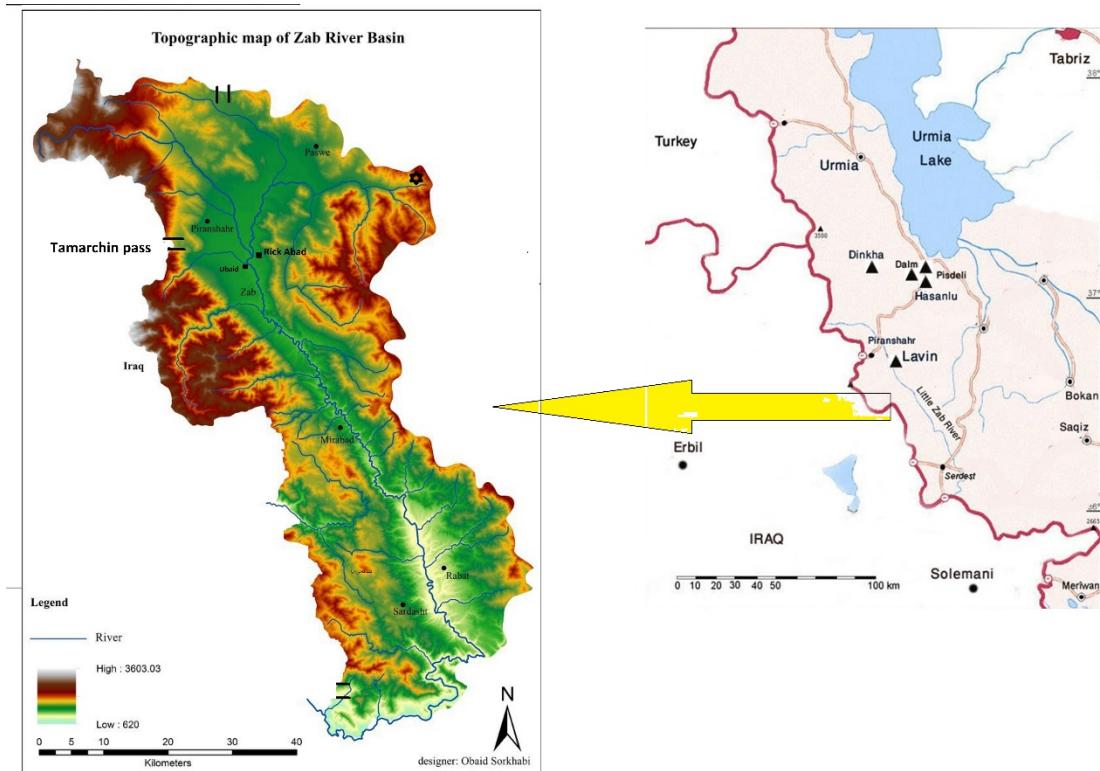


Figure 1. Location of Little Zab Basin in northwestern Iran.



Figure 2. Tepe Rick Abad, view from south.



Figure 3. Tepe Ubaid, view from east.

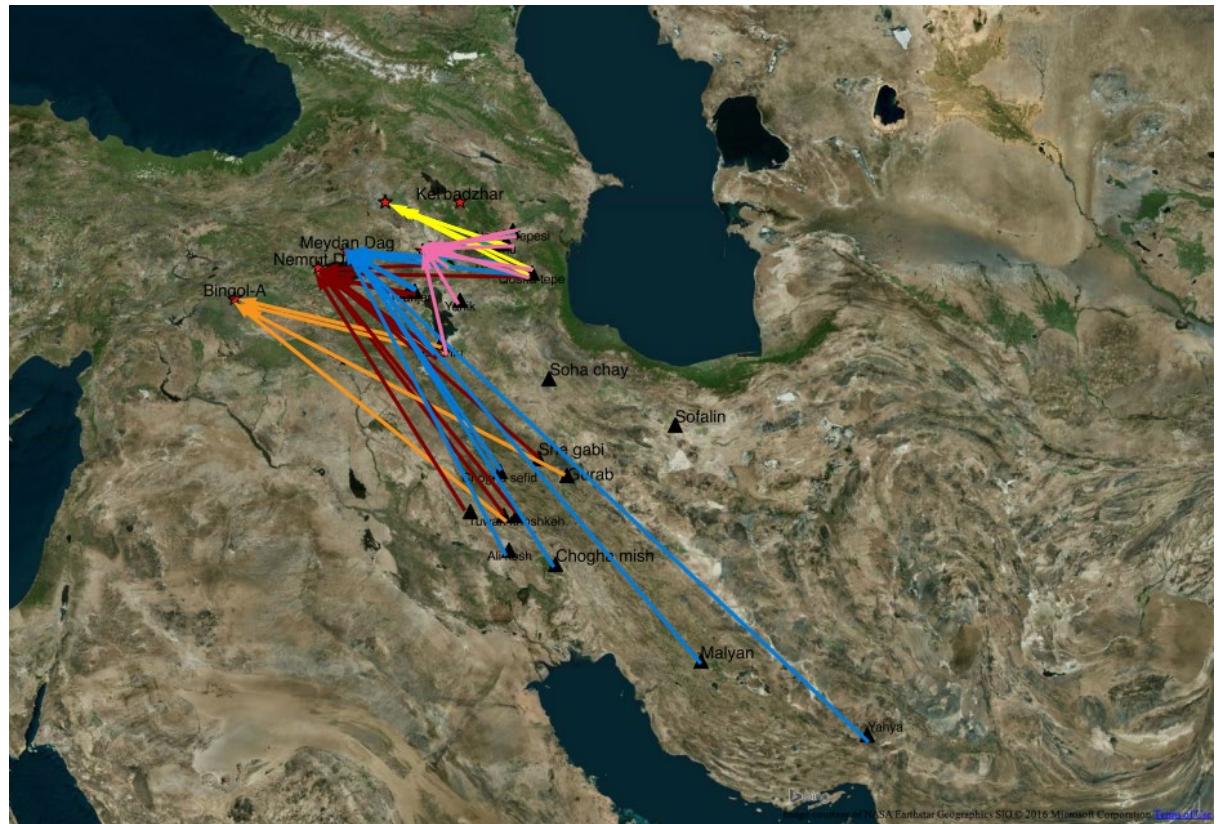


Figure 4. Archaeological sites and their identified sources (Maziar and Glascock, 2017).

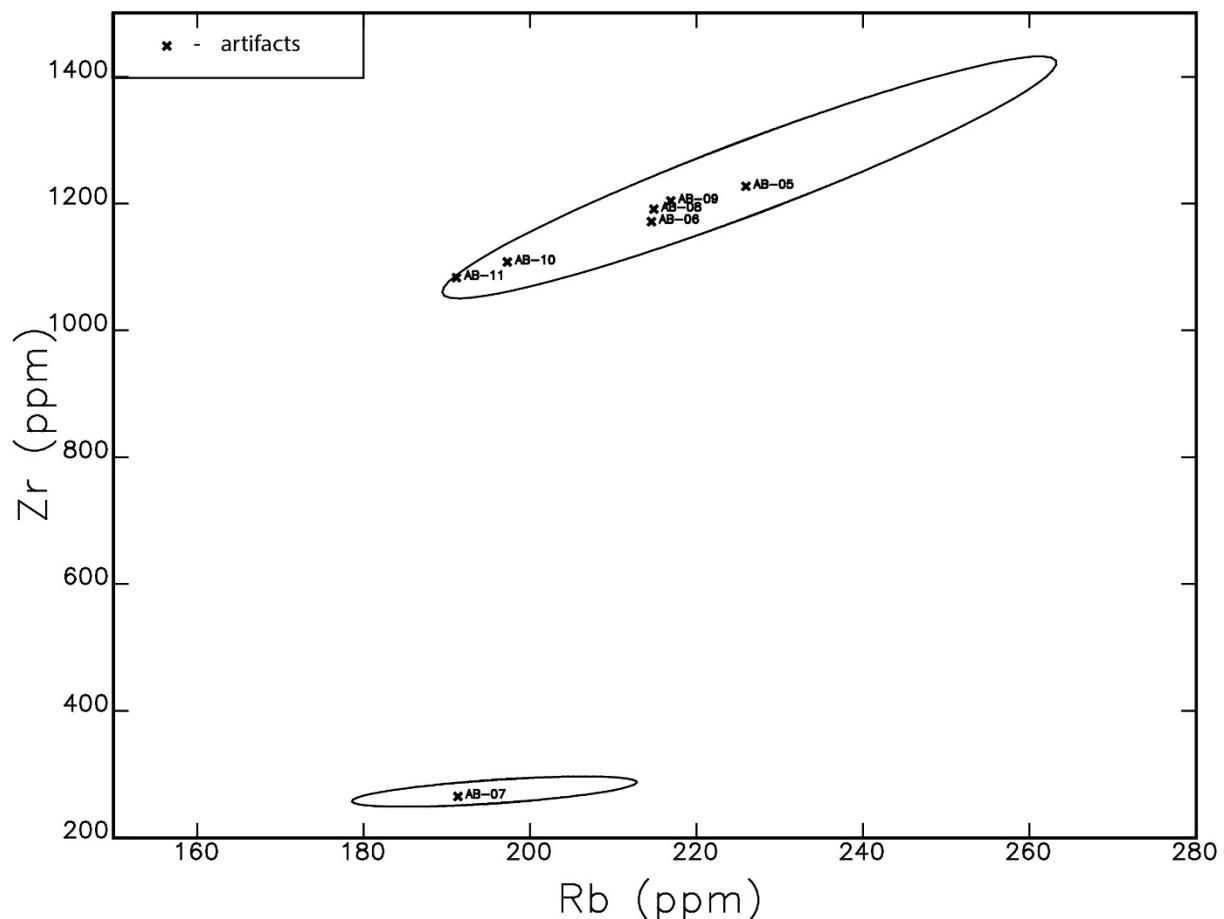


Figure 5. Scatterplot of Rb versus Zr for artifacts from Ubaid and Rick Abad compared to 90% confidence ellipses for Meydan Dağ and Nemrut Dağ sources.



Table 1. Concentrations for elements measured by XRF in artifacts from Rick Abad and Ubaid with source assignments

ANID	Source Name	K (%)	Ca (%)	Ti (ppm)	Mn (ppm)	Fe (%)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)	Th (ppm)
Rick Abad artifacts:													
AB-05	Nemrut Dağ	4.00	0.12	768	442.7	2.14	180	226	0.8	118	1227	61	27
AB-06	Nemrut Dağ	4.07	0.04	759	426.0	2.05	180	215	0.5	114	1172	60	27
Ubaid artifacts:													
AB-07	Meydan Dağ	3.60	0.03	468	513.8	0.92	72	191	14.4	50	265	30	24
AB-08	Nemrut Dağ	3.69	0.01	763	384.7	2.00	173	215	0.5	113	1191	59	25
AB-09	Nemrut Dağ	3.74	0.02	738	391.1	2.02	171	217	1.1	116	1204	60	25
AB-10	Nemrut Dağ	2.88	0.14	544	346.6	1.82	151	197	0.1	102	1108	57	25
AB-11	Nemrut Dağ	2.81	0.25	539	279.1	1.76	155	191	1.8	101	1083	55	23
JR-1 (Japanese Rhyolite) reference material used for quality control:													
JR-1	measured value	3.50	0.42	445	660.0	0.56	32	235	26.0	36	81	14	25
JR-1	reference value	3.66	0.48	660	770.0	0.62	31	242	29.0	45	90	15	27