The International Journal of Ancient Iranian Studies
July 2023, VOL. 3, NO. 5: 15-29. OPEN ACCESS
https://doi.org/10.22034/PA.2023.384534.1039

PERSICA ANTIQUA

RESEARCH ARTICLE

Aryans and the Sea Peoples: Migration and Invasion, Responses to the Climatic Stress in the Second Millennium BC

Babak Shaikh Baikloo Islam[1]

Abstract

The consequences of climate change could be so severe and extensive that the issue has prompted human societies to change their subsistence system and adopt strategies to deal with those challenges. In the past, droughts and the reduction in water resources caused serious problems for human societies and made it difficult for water-dependent communities to continue living in a specific region and area. In order to get out of the crisis, many communities either migrated to favorable areas or attacked other communities. In the second millennium BC, Central and West Asia witnessed large-scale human migrations and violent invasions, which apparently overlapped with climatic stresses. The extensive migration of Aryan tribes and predatory invasions of the Sea Peoples in Egypt, Levant, Anatolia, and Greece during the second half of the second millennium BC coincided with the 3.2 ka BP mega drought event. This research, with an environmental archeology approach, actually tries to warn about the unfortunate consequences of global warming, i.e. climate migrations and social tensions. Here, the reason for population displacements and attacks on civilizations in the second millennium BC has been investigated from the climatic perspective. The Paleoclimate research indicates frequent climatic events in the early Late Holocene in Central and West Asia, which probably triggered many socio-political events.

Keywords: Aryans; Sea Peoples; the 3.2 ka BP Event.

[1] Department of History and Archaeology, Science and Research Branch, Islamic Azad University, Tehran, Iran. babak.bagloo@srbiau.ac.ir

Article info: Received: 4 January 2023 | Accepted: 25 February 2023 | Published: 1 July 2023

Citation: Arabzadeh Sarbanani, Morteza. (2023). "Aryans and the Sea Peoples: Migration and Invasion, Responses to the Climatic Stress in the Second Millennium BC". *Persica Antiqua*, Vol. 3 (5): 15-29.
https://doi.org/10.22034/PA.2023.384534.1039

Introduction

One of the most unfortunate consequences of climate change is forced migration. According to the prediction of the Intergovernmental Panel on Climate Change, millions of people are likely to be displaced from their lands or will be forced to migrate in the coming decades, mainly due to extreme weather events and their effects on the subsistence patterns of communities (IPCC, 1990: 103; Pörtner *et al.*, 2022: 62-63). Besides, water stress has the potential to cause internal riots, war, migration, and insecurity by disrupting agricultural, animal husbandry, and industrial activities (Unfried *et al.*, 2022; Swain, 2015). This research, with the environmental archaeology approach, actually, intends to warn about the unfortunate consequences of climate change, because climate-related migrations can become big challenges for countries that absorb migrants. In addition, global warming researches give archaeologists an insight to analyze similar events in the past. According to research in Iran, drought and rising temperatures cause an increase in the migration of villagers due to the negative effects on agriculture (Jahangirpour & Bakhshoodeh, 2020). In archaeological studies, the abandonment of rural settlements in the third millennium BC in North Central Iran (Shaikh Baikloo *et al.*, 2016; 2020; Schmidt *et al.*, 2011) and northern Iraq (Weiss *et al.*, 1993) has been determined due to climatic change. In northern Mesopotamia, people apparently moved to the Tigris and Euphrates deltas in the southern regions due to severe droughts and dust storms caused by the 4.2 ka BP Megadrought event. In addition, it is possible that in the Early Bronze Age, the villagers of North Central Iran migrated to the northern humid regions, especially the Gorgan Plain. A pessimistic hypothesis is also that severe climatic hazards, famines, and outbreaks of deadly epidemics drastically reduced the population of this region in the early third millennium BC (Shaikh Baikloo, 2020: 40).

Roman Ghirshman (1939; 1954; 1977) proposed the hypothesis of Aryan migrants/invaders to the Iranian plateau based on the excavations at Tepe Sialk in Kashan and the period of long-term cultural decline between Sialk IV (Early Bronze Age) and Sialk V (Iron Age Cemetery A) as well as the appearance of gray pottery and burials in the mid-second millennium BC. Other excavations at Tepe Hissar, Damghan (Schmidt, 1937), Tepe Giyan, Nahavand (Contenau & Ghirshman, 1933; 1935), and Tepe Hassanlu in the south of Lake Urmia (Dyson, 1965; 1972; 1989) strengthened his hypothesis, which increased in number. Although with more advanced studies, especially Archaeogenetics, this hypothesis is no longer in its original form, the issue of human migrations in the second millennium BC is still valid. Robert Dyson (1965) and Kuyler Young (1967) believed that the transition from the Bronze Age to the Iron Age in Tepe Hassanlu was accompanied by significant cultural changes so that the Iron Age I cannot be considered a continuation of the previous culture and must have indicated the presence of new people (Aryans) in the region. Young (1965) based on the comparative study of Iron Age gray pottery in Tepe Hassanlu, Guy Tepe, Dinkhah Tepe in Northwest Iran, and Tepe Sialk, Tepe Khorvin, and Tepe Qeytarieh Tehran in North Central Iran introduced the appearance of this type of pottery as a sudden event. In fact, Dyson and Young attributed the Iron Age gray pottery to Aryan peoples. Furthermore,

Fig. 1. The Extent of the Bronze Age and Iron Age Cultures in Central Asia.

Young (1985) believed that the gray pottery of Northeast Iran had nothing to do with the Aryans.

In the first half of the second millennium BC, the civilizations of the Indus Valley, Central Asia, and East Iran collapsed and it seems that other peoples, probably the Indo-Iranians, replaced them. Other than that, other migrations and invasions also occurred in Southwest Asia. The attacks of the Sea Peoples to Western Asia Minor, the Levant, and the Nile Delta around 1200 BC, which led to the fall of the Hittite, Ugarit, and Mycenaean civilizations and challenged the Egyptian civilization, were important events of the last quarter of the second millennium BC. Interestingly, even the story of the exodus of the Israelites from Egypt is related to this time. High-resolution paleoclimate research indicates that between 1250 and 950 BC, a cold and dry period called the 3.2 ka BP drought event occurred, which was probably the main cause of migrations, invasions, and all kinds of socio-political tensions in the Middle East (Shaikh Baikloo, 2021; Kaniewski *et al.*, 2019a). In this article,

using paleoclimate research, the climatic conditions of the second millennium BC are reconstructed in order to investigate the cause of the aforementioned events with an environmental archaeology approach. It is worth noting that water-dependent communities were too vulnerable to any climatic fluctuations, and therefore, in order to survive, it was necessary to take effective action and use a variety of adaptation and resilience strategies. However, in some cases, they could not withstand climatic events. Iranian people, who always have been facing such challenges, often had effective cultural responses to deal with droughts. Most likely, the expansion of the pastoral nomadic subsistence system in Iran, especially in the Bronze and Iron Ages, was a strategy to adapt to climate change (Shaikh Baikloo & Chaychi, 2020).

Migrations and Invasions during the Second Millennium BC

Aryans

Proto-Indo-European homeland was the grasslands, north of the Black and Caspian Seas in what is today Ukraine and southern Russia, also known as the Pontic-Caspian steppe (Anthony, 2007: 83). According to a known hypothesis, the Indo-Europeans gradually migrated to Europe and Central Asia in several waves over hundreds of years from the Chalcolithic to the Bronze Age, one branch of which was the Indo-Iranians. The Indo-Iranian tribes were nomadic or semi-nomadic pastoralists who herded a variety of animals including goats and sheep, but their economy was based on cattle breeding. Milk, dairy products, meat, and leather were produced from this animal; its urine was used as a purifying agent; its dung fueled the fire; it could pull carts or plows; and furthermore, it played a central role in the religion of the Aryans (Malandra, 1983: 6-7). The common hypothesis says that the migration of the Indo-Iranians from the steppes of Central Asia to the south was done in several stages: the first took place between the 20th and 17th centuries BC; the second stage between the 16th and 14th centuries BC is related to the tribes that entered the Indus River valley and replaced the Harappan civilization; the third phase of migration between the 13th and 9th centuries BC is related to a branch of these tribes that came to the Iranian plateau. Based on archeological findings, the migration of the third group had been to Northeast Iran (Kuz'mina, 2007: 452-454).

In the wide region that was the passage of Aryans to Iran, during the second millennium BC, the Andronovo culture (ca. 2000-1450 BC) in western Siberia and the Central Eurasian steppes, the Bactria-Margiana archaeological complex (BMAC) or the Oxus/Amu Darya civilization (ca. 2250-1700 BC) and Yaz I culture (ca. 1500-1000 BC) in Turkmenistan existed (Fig. 1). In the early second millennium BC, the Indus Valley civilization transitioned to the post-urbanization phase, and the civilizations of Tepe Hissar, Shahdad, Tepe Yahya, Altyn Depe, and Gonur Depe gradually declined during the first half of the second millennium and were abandoned (Grigoriev, 2021; Lyonnet & Dubova, 2020; Sataev *et al.*, 2019; Vidale, 2017; Ascalone, 2006; Possehl, 1997) (Fig. 2).

According to Archaeogenetics, it has been determined that firstly, all the people living in Iran have genetic homogeneity, regardless of language difference (Farjadian *et al.*, 2011; Nasidze *et al.*, 2008); Secondly, the Iranian people have a significant genetic difference

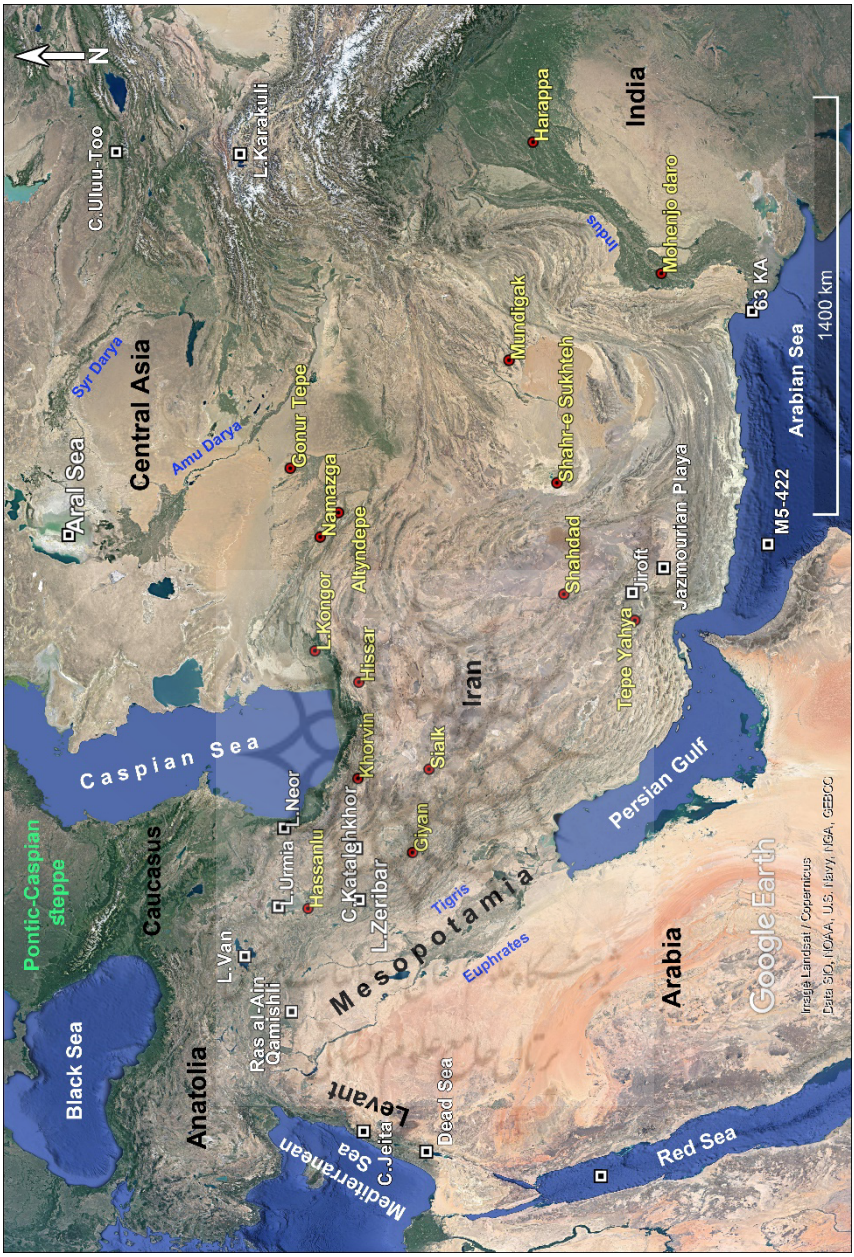

Fig. 2. The Geographical Situation of Southwest Asia. The Red Circles Indicate the Iron Age Sites and the White Squares Show the Paleoclimate Sites Mentioned in the Article.

from Anatolia and the Levant, meaning they show the greatest genetic similarity with the Caucasian people (Lazaridis et al., 2016; Schönberg *et al.*, 2011; Nasidze *et al.*, 2006); Thirdly, the populations that have been called Aryan in the history of Iran have not been very significant on the gene pool of Iranian natives, al-

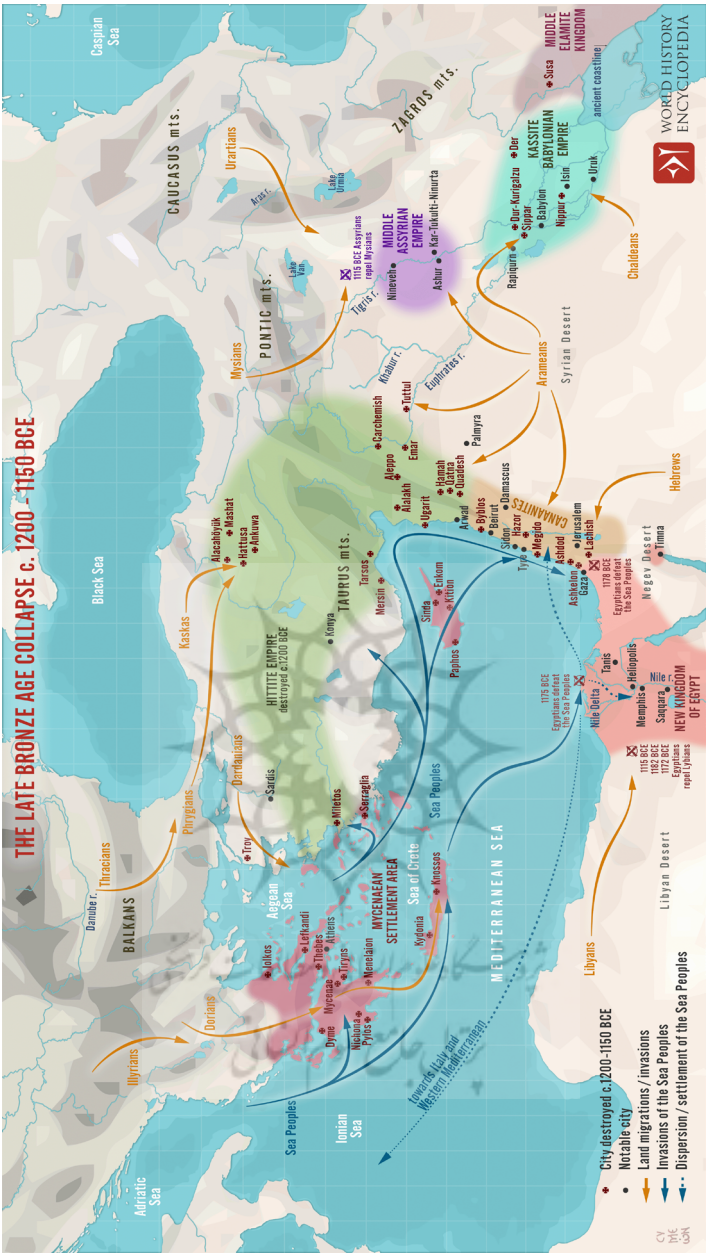

Fig. 3. The Invasions of Sea Peoples to Egypt, Levant, Anatolia, and Greece in1200-1150 BC (Netchev, 2022)

though their significant cultural effects on the language and religion of Iranians cannot be ignored (Vahdatinasab *et al.*, 2017). This means that there was cultural continuity in Iran during the Bronze Age and the newly arrived people were not so numerous that they could gain genetic superiority over native Iranians. Besides,

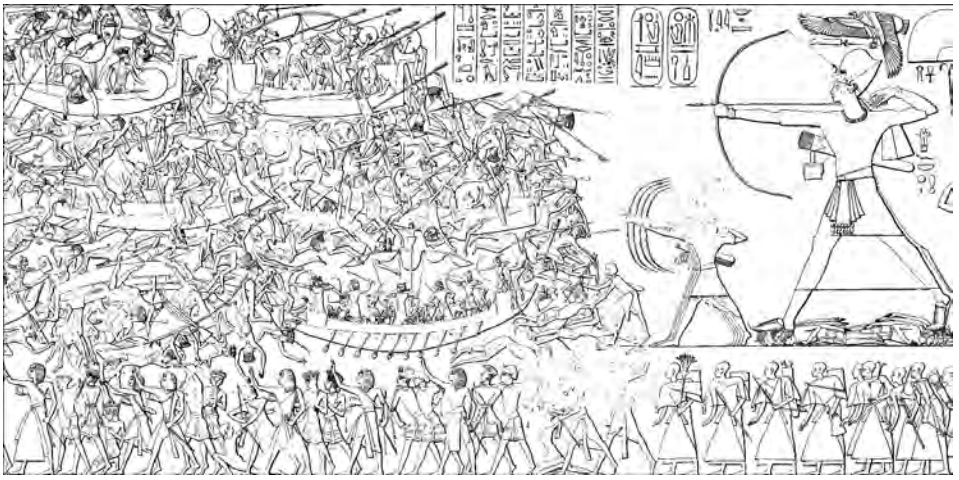

Fig. 4. The Battle of Ramses III and The Sea Peoples in The Nile Delta. Scene From the North Wall at Medinet Habu, Thebes (Sandars, 1987: 126-127)

the issue of the arrival of these ethnic groups to the Iranian plateau faces a challenge. It is worth mentioning that the main discussion is not about whether the Aryans entered Iran from the northeast or northwest, but the reason for this migration is important. Based on the recent Archaeogenetics, the hypothesis of the migration path of Aryans has been reversed. The mountainous region of the Caucasus, as a south-north bridge, had been the route of the first migration of Aryans to the steppes of Eurasia, and the Indo-European language was actually divided into several branches from the south of the Caucasus in Iran. One of its branches went to Anatolia, another to India, and the third one to the Yamnaya culture, also known as the Pit Grave culture or Ochre Grave culture (ca. 3300-2600 BC) through the Caucasus to the Pontic-Caspian Steppe and then went to Eastern Europe (Wang *et al.*, 2019; 2018).

According to the Avesta, Vendidad, Fargard 1 (1992: 659-660): "The first good land and country that I, Ahura Mazda, created was Irān-vij (airyana waējah), on the banks of the good Daitya river. So, then the deadly demon (Ahriman) came and created the dragon in the Daitya River by mischief and made the demon-created winter dominate the universe. There are ten months of winter and two months of summer and in those two months, the weather is cold for water, soil, and trees. Winter brings the worst damage there.". Can these statements be based on reality? Has a severe climatic event caused the migration of Aryans? Paleoclimate research is able to resolve this ambiguity. Further, previously, the location of Irān-vij was not known, but it may have been the Iranian plateau.

The Sea Peoples

No ancient inscription mentions anything about a confederacy called "Sea Peoples". The name was used for the first time by Gaston Maspero in ca 1881 CE. This French Egyptologist came up with the term because the ancient reports claim that these tribes came "from the sea". or from "the islands". but they never say which sea or which islands. Names of the tribes which comprised the Sea Peoples have been given in Egyptian records

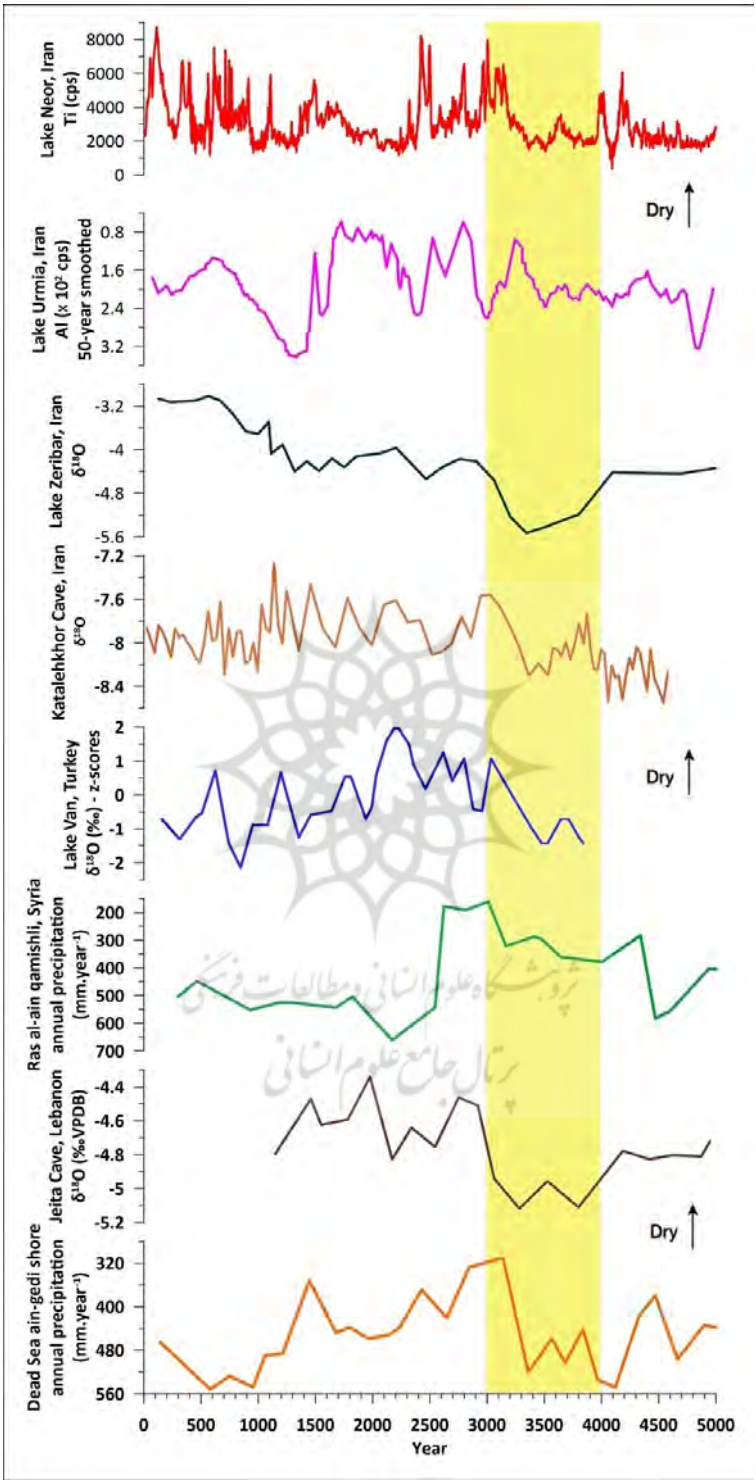

Fig. 5. Humidity Oscillations Over the Past 5000 Years. The Yellow Bar Indicates the Time Period Studied in This Article. References Are Cited in The Text.

as Sherden, Sheklesh, Lukka, Tursha, and Akawasha. Outside Egypt, they also attacked the Hittite Empire, the Levant, and other regions around the Mediterranean coast. They are considered one of the major contributing causes (or the primary cause) to the Late Bronze Age Collapse between ca. 1200 and 1150 BC (Mark, 2009) (Fig. 3).

The Sea Peoples presumably originated from various regions such as Western Anatolia, the Aegean Sea, the Mediterranean islands, and Southern Europe. The aim of their attacks was probably only looting, which they violently caused killing and damage. Besides, the issue of migration has also been raised by some researchers but no evidence of this hypothesis has been found in Egyptian inscriptions (Drews, 1995: 48-61). They may have been from the Aegean tribes, invaders from Central Europe, soldiers who joined pirates, or immigrants affected by climatic hazards or earthquakes. The collapse of Near East civilizations in the last quarter of the second millennium BC attributed to the attacks of sea people. These civilizations were suffering a dry climate event and famine around 1200 BC (Kaniewski *et al.*, 2015; 2019b).

The three pharaohs who have recorded their battles with the Sea Peoples are Ramesses II (reign 1279-1213 BC), Merneptah (r. 1213-1203 BC), and Ramesses III (r. 1186-1155 BC). All three claimed great victories over their enemies and their inscriptions provide the most detailed evidence of the Sea Peoples. Ramesses II tells about how he defeated the Sea Peoples of Sherden in a sea battle in the second year of his reign. Besides, in the inscription of his army's victory over the Hittites, he points out that the Sea Peoples were present in the armies of both opposing sides (Kitchen, 1982: 40-41). Merneptah also wrote on the walls of the Karnak temple and on the famous Merneptah stele from his funerary temple at Thebes about the alliance of Mereye, the leader of the Libyans, with the sea people as fierce enemies to attack Egypt and defeat them in the fifth year of his rule (Shaw, 2000: 294-295). The most important source of discussions about the Sea Peoples is the inscriptions of the mourning temple of Ramesses III of the 20th dynasty of Egyptian pharaohs in Medinet Habu, Thebes, located in Upper Egypt. This report is related to the war in the eighth year of the reign of Ramesses III (O'Connor, 2000; Roberts *et al.*, 2008) (Fig. 4).

Considering that the first year of the pharaoh's reign is not precisely known, this event may be related to 1178/1177 BC. Based on radiocarbon dating, the chaotic scene of the battle of boats and warriors in the Nile Delta has been dated between ca. 1188 and 1177 BC (Bronk-Ramsey *et al.*, 2010; Kaniewski *et al.*, 2011; Cline, 2014). In this invasion, as in the earlier one, the Sea Peoples were allied with Libyans and they had already destroyed the Hittite state in ca. 1200 BC. As in the past, Egyptian documents record a glorious and crushing victory in the city of Xois in which many of the Sea Peoples were killed or enslaved. After that, there are no more reports about the Sea Peoples in Egyptian historical documents. One of the negative consequences of this war for the Egyptian state was the emergence of economic problems that caused the tomb construction workers to strike (Lesko, 1994: 38).

Climatic Conditions in the Second Millennium BC

Iran and Indus Valley

The research on Lake Neor Ardabil indicates an increase in dry climatic conditions during the 4.2 ka BP (2200-1900

BC) and 3.2 ka BP (1250-950 BC) drought events, and between these two periods the dust flux was at a minimum (with a peak in ca. 3600-3700 BP) which indicates an increase in humidity (Sharifi *et al.*, 2015). According to the Katalehkhor Cave research, Zanjan, the humidity gradually decreased with oscillations during the second millennium BC and in ca. 3000 BP reached its minimum. However, in the mid-millennium, the humidity was higher than in the early and late, which displays the effect of the mentioned drought events (Andrews *et al.*, 2020). Such conditions are also illustrated by the paleoclimate research on Lake Kongor in Gorgan Plain (Shumilovskikh *et al.*, 2016). The research on Lake Zaribar, Kurdistan, suggests that after the 4.2 ka BP event, in the early second millennium BC, the humidity increased significantly, but during the millennium, it followed a decreasing trend (Stevens *et al.*, 2001). The research on Lake Urmia represents a gradual decrease in humidity during the second millennium BC, which reached its minimum with the onset of the 3.2 ka BP event (Sharifi *et al.*, 2019). The research on Lake Van in eastern Turkey also shows such conditions (Wick *et al.*, 2003). The 3200 ka BP event seems to have drastically reduced the rainfalls associated with the Westerlies. The paleoclimate research on the north of the Red Sea (which is important for the reconstruction of the climate of the south, southwest, west, and center of Iran) also clearly shows this event, while the rest of the second millennium BC had a higher humidity (Arz *et al.*, 2003). Paleoclimate research on a peat bog near the Konar Sandal site, Jiroft (which is important for the reconstruction of monsoon rains) indicates dry periods around 4000-3800 and 3400-2800 BP. Around 3800-3400 BP, a more moderate climate prevailed (Gurjazkaite *et al.*, 2018).

Paleoclimate research near the Indus River Delta (core 63 KA) indicates dry climatic conditions from about 4200 to 3200 BP, with a relative increase in humidity in ca. 3500 BP. In the last quarter of the second millennium BC, humidity in this region has been gradually increasing (Staubwasser *et al.*, 2003). The research on the Gulf of Oman (core M5-422) illustrates almost the same conditions. According to these two studies, the driest climatic conditions prevailed during the 4.2 ka BP event (Cullen et al., 2000). Recent research conducted near Konar Sandal has shown that the most severe drought of the Holocene occurred during this event (Safaierad *et al.*, in press).

Central Asia

During the Late Bronze Age and Early Iron Age, between 4000 and 3000 BP, the water level of the Aral Sea did not exceed 42 to 43 meters above sea level. This indicates the dry climatic conditions of this region during the mentioned period (Boroffka *et al.*, 2006; Boroffka, 2010). The research on the sediments of Lake Kalakuli at the westernmost edge of Xinjiang an open freshwater lake with a maximum depth of 20 m located at an altitude of 3650 m indicates relatively warm and dry conditions between about 4200 and 3400 BP. After that, a gradual cooling process started, which, stopped with a warmer and drier period between about 3000 and 2700 BP and then reached the coldest and wettest conditions at ca. 2500 BP (Aichner *et al.*, 2015). Another study on the Uluu-Too cave located on the southern rim of the Fergana Valley in Kyrgyzstan shows a dry climate in 4000-4700 BP. At ca. 4300-4200 and 4000 BP, the humidity increased to some extent. Around 4000-3500 BP, humidity gradually decreased and dry conditions reached

a peak around 3600 BP. In the following, the humidity increased around 3500-3200 BP, but thereafter, it gradually decreased again and reached the maximum drought around 2500 BP. Besides, around 3600, 3200, and 3000 BP, the dust input increased which indicates drought peaks (Wolff *et al.*, 2017).

Levant

Research on Dead Seaain-gedi shore indicates relatively humid climatic conditions with some decreasing fluctuations in the first half of the second millennium BC. From 3400 BP to the end of this millennium, humidity decreased drastically (Litt *et al.*, 2012). The paleoclimate research on Ras al-An Qamishli in Syria (Bryson & Bryson, 1997) and Jeita Cave in Lebanon (Verheyden *et al.*, 2008) also show almost the same trend. These studies clearly indicate the drought peak in the 3.2 ka BP event. According to the Greenland Ice Sheet Project 2 (GISP2), which identified significant warming at 3300 BP (Alley, 2004), the relative increase in humidity in the interval ca 3500-3200 BP, visible in the studies of Katalehkhor cave (Andrews *et al.*, 2020), Lake Neor (Sharifi *et al.*, 2015), Lake Zeribar (Stevens *et al.*, 2001), Lake Urmia (Sharifi *et al.*, 2019), Jazmourian Playa (Vaezi *et al.*, 2019), Konar Sandal Jiroft (Gurjazkaite *et al.*, 2018), Indus River Delta (Staubwasser *et al.*, 2003) and Uluu-Too Cave in Kyrgyzstan (Wolff *et al.*, 2017), was probably related to this warm period.

Summary

By examining paleoclimate research (with an emphasis on high-resolution research), it can be summarized that after the 4.2 ka BP dry event, which lasted until about 3900 BP, the humidity increased to some extent, but apparently, until about 3500 BP, relatively dry conditions with fluctuations in improving humidity prevailed. It seems that there was a dry event centered around 3600 BP. Then, since ca. 3500 BP, the humidity increased for about two to three centuries, but with the occurrence of the 3.2 ka BP event, the humidity decreased significantly until the early first millennium BC. Therefore, the Late Bronze Age and the Early Iron Age in Central Asia and Southwest Asia were associated with numerous climatic oscillations (Fig. 5).

Conclusion

Drought has always been a fatal event for the water-dependent farmer and livestock breeder communities and forced them to carry out various resilience strategies in order to survive. Migration has been one of the important strategies of human adaptation to severe climatic and environmental changes, which is still happening in connection with global warming. In ancient times, migrations were associated with violence in many cases due to the cultural level of the immigrant people or not being accepted by the destination natives. Due to the fact that today's climatic migrations because of political restrictions are definitely not as easy as in ancient times, the difficult migration conditions of people suffered by climate change can increase violence and social conflicts. The invasions of Sea Peoples and extensive migrations of Aryans, which coincided with the climate stress, caused socio-political tensions for a long time and led to the collapse of some ancient civilizations during the Late Bronze Age. According to paleoclimate research, probably the most severe abrupt climate change in the second millennium BC was the 3.2 ka BP drought event. During this event, many migrations and invasions occurred in the

Middle East. The Sea peoples destroyed the civilizations of the Eastern Mediterranean, Asia Minor, and Greece, and they attacked Egypt several times, and according to Egyptian historical sources, they suffered heavy defeats. From this time, for three to four centuries, many civilizations in this region experienced historical darkness. On the Iranian plateau, where there was a significant cultural disruption during the Late Bronze Age, a new culture emerged in the second half of the second millennium BC, which is known as the Iron Age. Traditional knowledge indicates a widespread migration of Aryan peoples to Iran at that time. However, the Archaeogenetics show that not only there were no large-scale migrations to the Iranian plateau (because a new and dominant gene pool did not appear), but even migrations from the Iranian plateau through the Caucasus to other regions were carried out. This finding indicates that firstly, ritual treatises should not be approved without questioning and research; secondly, the disappearance of many Iranian Bronze Age settlements should not be considered a cultural collapse or social destruction because people probably changed their subsistence system to adapt to the new environmental conditions from sedentary to nomadism, or migrated to more favorable areas. Therefore, considering Iran's vulnerable environment against climate change, it is quite possible that in the second millennium BC, especially during the 3.2 ka BP event, migrations from the Iranian plateau took place abroad. After this drought event, with the relative increase in humidity, the number of settlements (not cemeteries) in Iran has gradually increased since the early first millennium BC.

Bibliography

Bergey, Ron. (1984). "Late Linguistic Features in Esther". *The Jewish Quarterly Review* 75(1):66-78.

Aichner, B., Feakins, S.J., Lee, J.E., Herzschuh, U. & X. Liu, (2015). "High-resolution leaf wax carbon and hydrogen isotopic record of the late Holocene paleoclimate in arid Central Asia". *Climate of the Past* 11(4): 619-633. https://doi.org/10.5194/cp-11-619-2015

Alley, R.B. (2004) NOAA/WDS Paleoclimatology-GISP2-Temperature Reconstruction and Accumulation Data. https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=noaa-icecore-2475

Andrews, J.E., Carolin, S.A., Peckover, E.N., Marca, A., Al-Omari, S. & P.J. Rowe, (2020). "Holocene stable isotope record of insolation and rapid climate change in a stalagmite from the Zagros of Iran". *Quaternary Science Reviews* 241: 106433. https://doi.org/10.1016/j.quascirev.2020.106433

Arz, H. W., Lamy, F., Patzold, J., Muller, P. J. & M. Prins, (2003). "Mediterranean moisture source for an Early-Holocene humid period in the northern Red Sea". *Science* 300(5616): 118-121. https://doi.org/10.1126/science.1080325

Avesta (1992). *Avesta, the oldest Iranian poems and texts,* Vol. 2, Report and research of Jalil Dostkhah. Tehran: Morvarid Publications.

Anthony, D.W. (2010). *The Horse, the Wheel and Language: How bronze-age riders from the Eurasian steppes shaped the modern world*. Princeton University Press. Access on: https://archive.org/details/horsewheelandlanguage/page/99/mode/2up

Ascalone, E. (2006). *Archeologia dell'Iran antico: interazioni, integrazioni e discontinuità nell'Iran del III millennio a.C.*, Vol. 14, Messina Di. Sc. A. M.

Boroffka, N.G.O. (2010). "Archaeology and Its Relevance to Climate and Water Level Changes: A Review". In A. Kostianoy, A. Kosarev (eds.), *The Aral Sea Environment*. The Handbook of Environmental Chemistry, Vol. 7, Springer, Berlin, Heidelberg. 283-303 https://doi.org/10.1007/698_2009_1

Boroffka, N.G.O., Oberhänsli, H., Sorrel, P., Demory, F., Reinhardt, C., Wünnemann, B., Alimov, K., Baratov, S., Rakhimov, K., Saparov, N. & U. Röhl, (2006). "Archaeology and climate: Settlement and lake-level changes at the Aral Sea". *Geoarchaeology* 21(7): 721-734. https://doi.org/10.1002/gea.20135

Bronk-Ramsey, C., Dee, M.W., Rowland, J.M., Higham, T.F., Harris, S.A., Brock, F., Quiles, A., Wild, E.M., Marcus, E.S. & A.J. Shortland, (2010). "Radiocarbon-based chronology for dynastic Egypt". *Science* 328(5985): 1554-1557. https://doi.org/10.1126/science.1189395

Bryson, R. A. & R.U. Bryson, (1997). High resolution simulations of regional Holocene climate:

North Africa and the Near East. In H.N., HDalfes, G., Kukla, H., Weiss (eds.), *Third millennium BC climate change and Old World collapse*. Springer, Berlin, Heidelberg. 565-593. https://doi.org/10.1007/978-3-642-60616-8_25

Cline, E.H. (2014). *1177 BC: The year civilization collapsed.* Princeton: Princeton University Press. https://doi.org/10.1515/9781400849987

Contentau, J. & Ghrishman, R. (1935). *Fouilles du Tépé-Giyan: près de Néhavend, 1931 et 1932*. Série archéologique / Département des Antiquités Orientales, Musée du Louvre, Paris: Paul Geuthner.

Contenau, G. & R. Ghirshman, (1933). "Rapport préliminaire sur les fouilles de Tépé-Giyan, près Néhavend (Perse) Première campagne (1931)". *Syria*, 1-11. https://doi.org/10.3406/syria.1933.3668

Cullen, H.M., Demenocal, P.B., Hemming, S., Hemming, G., Brown, F.H., Guilderson, T. & F. Sirocko, (2000). "Climate change and the collapse of the Akkadian empire: Evidence from the deep sea". *Geology* 28(4): 379-382. https://doi.org/10.1130/0091-7613(2000)28<379:CCATCO>2.0.CO;2

Drews, R. (1993). *The End of the Bronze Age: Changes in Warfare and the Catastrophe of ca. 1200 B.C.* Princeton: Princeton University Press.

Dyson Jr, R.H. (1989). "Rediscovering Hasanlu". *Expedition* 31(2-3): 3-11.

Dyson Jr, R.H. (1972). The Hasanlu Project 1961-1967. In *The Memorial Volume of the International Congress of Iranian Art and Archaeology, 1968*. 39-58.

Dyson Jr, R.H. (1965). "Problems of Protohistoric Iran as seen from Hasanlu". *Journal of Near Eastern Studies* 24(3): 193-217. https://doi.org/10.1086/371815

Farjadian, S., Sazzini, M., Tofanelli, S., Castrì, L., Taglioli, L., Pettener, D., Ghaderi, A., Romeo, G. & D. Luiselli, (2011). "Discordant patterns of mtDNA and ethno-linguistic variation in 14 Iranian Ethnic groups". *Human heredity* 72(2): 73-84. https://doi.org/10.1159/000330166

Ghirshman, R. (1977). *L'Iran et la migration des Indo-Aryens et des Iraniens*. Leiden: Brill Archive.

Ghirshman, R. (1954). *Iran: from the earliest times to Islamic conquest*. Repr. Harmondsworth: Penguin Books.

Ghirshman, R. (1939). *Fouilles de Sialk: près de Kashan, 1933, 1934, 1937,* Vol 2, Paris: Geuthner.

Grigoriev, S. (2021). "Andronovo problem: studies of cultural genesis in the Eurasian Bronze Age". *Open Archaeology* 7(1): 3-36. https://doi.org/10.1515/opar-2020-0123

Gurjazkaite, K., Routh, J., Djamali, M., Vaezi, A., Poher, Y., Beni, A.N., Tavakoli, V. & H. Kylin, (2018). Vegetation history and human-environment interactions through the late Holocene in Konar Sandal, SE Iran. *Quaternary Science Reviews* 194: 143-155. https://doi.org/10.1016/j.quascirev.2018.06.026

IPCC (1992). *Climate Change: The 1990 and 1992 IPCC Assessments, First Assessment Report, Overview and Policymaker Summaries and 1992 IPCC Supplement.* Access on: https://www.ipcc.ch/site/assets/uploads/2018/05/ipcc_90_92_assessments_far_full_report.pdf

Jahangirpour, D. & M. Bakhshoodeh, (2020). "The Impact of Climate Change on Rural Migration in Iran: Application of Panel VAR Approach". *Environmental Researches* 11(21): 133-142. https://dorl.net/dor/20.1001.1.20089597.1399.11.21.12.1

Kaniewski, D., Marriner, N., Bretschneider, J., Jans, G., Morhange, C., Cheddadi, R., Otto, T., Luce, F. & E. Van Campo, (2019a). "300-year drought frames Late Bronze Age to Early Iron Age transition in the Near East: new palaeoecological data from Cyprus and Syria". *Regional Environmental Change* 19: 2287-2297. https://doi.org/10.1007/s10113-018-01460-w

Kaniewski, D., Marriner, N., Cheddadi, R., Morhange, C., Bretschneider, J., Jans, G., Otto, T., Luce, F. & E. Van Campo, (2019b). "Cold and dry outbreaks in the eastern Mediterranean 3200 years ago". *Geology* 47(10): 933-937. https://doi.org/10.1130/G46491.1

Kaniewski, D., Guiot, J. & E. Van Campo, (2015). "Drought and societal collapse 3200 years ago in the Eastern Mediterranean: a review". *Wiley Interdisciplinary Reviews: Climate Change* 6(4): 369-382. https://doi.org/10.1002/wcc.345

Kaniewski, D., Van Campo, E., Van Lerberghe, K., Boiy, T., Vansteenhuyse, K., Jans, G., Nys, K., Weiss, H., Morhange, C., Otto, T. & J. Bretschneider, (2011). The Sea Peoples, from cuneiform tablets to carbon dating. *PLoS One* 6(6): e20232. https://doi.org/10.1371/journal.pone.0020232

Kitchen, K.A. (1982). *Pharaoh triumphant: the life and times of Ramesses II, king of Egypt*. Mississauga, Ont.: Benben Publications.

Kuz'mina, E. E. (2007). *The origin of the Indo-Iranians*, Vol. 3, Leiden: Brill.

Lazaridis, I., Nadel, D., Rollefson, G., Merrett, D.C., Rohland, N., Mallick, S., Fernandes, D., Novak, M., Gamarra, B., Sirak, K. & D. Reich, (2016). "Genomic insights into the origin of farming in the ancient Near East". *Nature* 536(7617): 419-424. https://doi.org/10.1038/nature19310

Lesko, L.H. (ed.). (1994). *Pharaoh's workers: the villagers of Deir el Medina*. Ithaca and London: Cornell University Press.

Litt, T., Ohlwein, C., Neumann, F. H., Hense, A. & M. Stein, (2012). "Holocene climate variability in the Levant from the Dead Sea pollen record". *Quaternary Science Reviews* 49: 95-105. https://doi.org/10.1016/j.quascirev.2012.06.012Get rights and content

Lyonnet, B. & N.A. Dubova, (eds.). (2020). *The World of the Oxus civilization*. New York: Routledge.

Malandra, W.W. (ed.). (1983). *An introduction to ancient Iranian religion: Readings from the Avesta and Achaemenid inscriptions*, Vol. 2, Minnesota: University of Minnesota Press.

Mark, J.J. (2009, September 02). Sea Peoples. In *World History Encyclopedia*. Retrieved from https://www.worldhistory.org/Sea_Peoples/

Nasidze, I., Quinque, D., Rahmani, M., Alemohamad, S.A. & M. Stoneking, (2008). "Close genetic relationship between Semitic-speaking and Indo-European-speaking groups in Iran". *Annals of human genetics* 72(2): 241-252. https://doi.org/10.1111/j.1469-1809.2007.00413.x

Nasidze, I., Quinque, D., Rahmani, M., Alemohamad, S. A. & M. Stoneking, (2006). "Concomitant Replacement of Language and mtDNA in South Caspian Populations of Iran". *Current Biology* 16(7): 668-673. https://doi.org/10.1016/j.cub.2006.02.021

Netchev, S. (2022, March 01). The Late Bronze Age Collapse c. 1200 - 1150 BCE. In *World History Encyclopedia*. Retrieved from https://www.worldhistory.org/image/15310/the-late-bronze-age-collapse-c-1200---1150-bce/

O'Connor, D. (2000). The Sea Peoples and the Egyptian Sources. In E. D. Oren (ed.), *The Sea Peoples and Their World: A Reassessment*. Pennsylvania: University of Pennsylvania Press. 85-102. https://doi.org/10.9783/9781934536438

PÖrtner, H.O., Roberts, D.C., Adams, H., Adler, C., Aldunce, P., Ali, E., Begum, R.A., Betts, R., Kerr, R.B., Biesbroek, R. & J. Birkmann, (2022). Climate change 2022: Impacts, adaptation and vulnerability. In *IPCC Sixth Assessment Report*. 37-118. Access on: https://www.ipcc.ch/report/ar6/wg2/

Roberts, R.G. (2008). Identity, choice, and the Year 8 reliefs of Ramesses III at Medinet Habou. In C. Bachhuber, R.G. Roberts (eds.), *Forces of transformation: The end of the Bronze Age in the Mediterranean.* Oxford: Oxbow. 60-68.

Sandars, N.K. (1987). *The Sea Peoples: warriors of the ancient Mediterranean 1250-1150 BC*. (Ancient peoples and places). London: Thames and Hudson.

Sataev, R.M., Dubova, N.A. & M.A. Mamedov, (2019). The internal chronology and periodization of Gonur Depe. In *Antiquities of East Europe, South Asia and South Siberia in the context of connections and interactions within the Eurasian cultural space* (*new data and concepts*): *Proceedings of the International Conference*, Vol 1, November 18–22, 2019, St. Petersburg. 40-41. Access on: https://www.archeo.ru/izdaniya-1/vagnejshije-izdanija/pdf/2019Drevnosty1.pdf

Schmidt, A., Quigley, M., Fattahi, M., Azizi, G., Maghsoudi, M. & H. Fazeli, (2011). "Holocene settlement shifts and palaeoenvironments on the Central Iranian Plateau: investigating linked systems". *The Holocene* 21(4): 583-595. https://doi.org/10.1177/0959683610385961

Schmidt, E.F. (1937). *Excavations at Tepe Hissar, Damghan*. Pennsylvania: University of Pennsylvania Press.

SchÖnberg, A., Theunert, C., Li, M., Stoneking, M. & I. Nasidze, (2011). "High-throughput sequencing of complete human mtDNA genomes from the Caucasus and West Asia: high diversity and demographic inferences". *European journal of human genetics* 19(9): 988-994. https://doi.org/10.1038/ejhg.2011.62

Shaikh Baikloo Islam, B. (2021). "Southwest Asia during the Iron Age from the perspective of climatic events". *Journal of Iran's Pre Islamic Archaeological Essays* 5(2): 63-76. (in Persian)

Shaikh Baikloo Islam, B. (2020). "Holocene climatic events in Iran". *Climate Change Research* 1(4): 35-48. https://doi.org/10.30488/ccr.2020.244327.1017

Shaikh Baikloo Islam, B. & A. Chaychi Amirkhiz, (2020). "Adaptations of the Bronze and Iron Ages Societies of North Central Iran to the Holocene Climatic Events". *Climate Change Research* 1(2): 39-54. (in Persian) https://doi.org/10.30488/ccr.2020.111121

Shaikh Baikloo Islam, B., Chaychi Amirkhiz, A. & K. Niknami, (2020). "Late Holocene climatic events, the main factor of the cultural decline in North Central Iran during the Bronze Age". *Documenta Praehistorica* 47: 446-460. https://doi.org/10.4312/dp.47.25

Shaikh Baikloo Islam, B., Chaychi Amirkhiz, A. & H. Valipour, (2016). "On the Possible Correlation between the Collapse of Sialk IV and Climatological Events during the Middle–Late Holocene". *Iranian Journal of Archaeological Studies* 6(1): 45-57. https://doi.org/10.22111/ijas.2016.3770

Sharifi, A., Pourmand, A., Djamali, M., Peterson, L.C., Swart, P.K., Ávila, M.G.P., Esfahaninejad, M. & H.A. Lahijani, (2019, December). "The Rise and Demise of the world's second largest hypersaline lake: The Past is Prologue to the Future of Urmia Lake", In *AGU Fall Meeting 2019*, AGU. Bibcod: 2019AGUFMPP51F1439S. Access on: https://ui.adsabs.harvard.edu/#abs/2019AGUFMPP51F1439S/abstract

Sharifi, A., Pourmand, A., Canuel, E.A., Ferer-Tyler, E., Peterson, L.C., Aichner, B., Feakins, S.J., Daryaee, T., Djamali, M., Beni, A.N. & H.A. Lahijani, (2015). "Abrupt climate variability since the last deglaciation based on a high-resolution, multi-proxy peat record from NW Iran: The hand that rocked the Cradle of Civilization?". *Quaternary Science Reviews 123: 215-230.* https://doi.org/10.1016/j.quascirev.2015.07.006

Shaw, I. (Ed.). (2003). *The Oxford history of ancient*

Egypt. Oxford: Oxford University Press.

Shumilovskikh, L. S., Hopper, K., Djamali, M., Ponel, P., Demory, F., Rostek, F., Tachikawa, K., Bittmann, F., Golyeva, A., Guibal, F. & V. Andrieu-Ponel, (2016). "Landscape evolution and agro-sylvo-pastoral activities on the Gorgan Plain (NE Iran) in the last 6000 years". *The Holocene* 26(10): 1676-1691. https://doi.org/10.1177/0959683616646841

Staubwasser, M., Sirocko, F., Grootes, P.M. & M. Segl, (2003). "Climate change at the 4.2 ka BP termination of the Indus valley civilization and Holocene South Asian monsoon variability". *Geophysical Research Letters* 30(8). https://doi.org/10.1029/2002GL016822

Stevens, L.R., Wright Jr, H. E. & E. Ito, (2001). "Proposed changes in seasonality of climate during the Lateglacial and Holocene at Lake Zeribar, Iran". *The Holocene* 11(6): 747-755. https://doi.org/10.1191/095968301957 62

Swain, A. (2015). "Water wars". *International Encyclopedia of the Social & Behavioral Sciences* 25: 443-447. http://dx.doi.org/10.1016/B978-0-08-097086-8.91087-0

Unfried, K., Kis-Katos, K. & T. Poser, (2022). "Water scarcity and social conflict". *Journal of Environmental Economics and Management* 113: 102633. https://doi.org/10.1016/j.jeem.2022.102633

Vaezi, A., Ghazban, F., Tavakoli, V., Routh, J., Beni, A.N., Bianchi, T.S., Curtis, J.H. & H. Kylin. (2019). "A Late Pleistocene-Holocene multi-proxy record of climate variability in the Jazmurian playa, southeastern Iran", *Palaeogeography, palaeoclimatology, palaeoecology* 514: 754-767. doi.org/10.1016/j.palaeo.2018.09.026

Vahdatinasab, H., Anvari, Z., Ghamari Fatideh, M., Sheykholeslami, A., Akbari, M. T. & N. Lesani, (2017). "Dispersals of the Aryans into the Iranian Plateau in the Light of New Genetic Discoveries, Case Study: Gohar Teppe Iron Age Cemetery, Behshahr, IRAN". *Iranian Journal of Anthropological Research* 7(1): 117-143. (in Persian) https://doi.org/10.22059/ijar.2017.65922

Vidale, M. (2017). *Treasures from the Oxus: The Art and Civilization of Central Asia*. London New York: I. B. Tauris.

Verheyden, S., Nader, F. H., Cheng, H. J., Edwards, L. R. & R. Swennen, (2008). "Paleoclimate reconstruction in the Levant region from the geochemistry of a Holocene stalagmite from the Jeita cave, Lebanon". *Quaternary Research* 70(3): 368-381. https://doi.org/10.1016/j.yqres.2008.05.004

Young Jr, T. C. (1985). Early Iron Age Iran Revisited. Preliminary Suggestions for the Reanalysis of Old Constructs. In J.-L., Huot, M., Yon, Y., Calvet (eds.), *De l'Indus aux Balkans*. Recueil à la mémoire de Jean Deshayes, Paris. 361-78.

Young Jr, T.C. (1967). "The Iranian migration into the Zagros". *Iran* 5(1): 11-34. https://doi.org/10.1080/05786967.1967.11834760

Young Jr, T.C. (1965). "A comparative ceramic chronology for Western Iran, 1500–500 BC". *Iran* 3(1): 53-85. https://doi.org/10.2307/4299561

Wang, C.C., Reinhold, S., Kalmykov, A., Wissgott, A., Brandt, G., Jeong, C., Cheronet, O., Ferry, M., Harney, E., Keating, D. & S. Mallick, (2019). "Ancient human genome-wide data from a 3000-year interval in the Caucasus corresponds with eco-geographic regions". *Nature communications* 10(1): 590. https://doi.org/10.1038/s41467-018-08220-8

Wang, C. C., Reinhold, S., Kalmykov, A., Wissgott, A., Brandt, G., Jeong, C., Cheronet, O., Ferry, M., Harney, E., Keating, D. & W. Haak, (2018). "The genetic prehistory of the Greater Caucasus". *bioRxiv*, 322347. http://dx.doi.org/10.1038/s41467-018-08220-8

Weiss, H., Courty, M.A., Wetterstrom, W., Guichard, F., Senior, L., Meadow, R. & A. Curnow, (1993). "The genesis and collapse of third millennium north Mesopotamian civilization". *Science 261(5124): 995-1004.* https://doi.org/10.1126/science.261.5124.995

Wick, L., Lemcke, G. & M. Sturm, (2003). "Evidence of Lateglacial and Holocene climatic change and human impact in eastern Anatolia: high-resolution pollen, charcoal, isotopic and geochemical records from the laminated sediments of Lake Van, Turkey". *The holocene* 13(5): 665-675. https://doi.org/10.1191/0959683603hl653rp

Wolff, C., Plessen, B., Dudashvilli, A.S., Breitenbach, S.F., Cheng, H., Edwards, L.R. & M.R. Strecker, (2017). "Precipitation evolution of Central Asia during the last 5000 years". *The Holocene* 27(1): 142-154. https://doi.org/10.1177/0959683616652711