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Chapter 13

THE SUN, CLIMATE CHANGE AND THE EXPANSION OF THE SCYTHIAN CULTURE AFTER 850 BC

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ABSTRACT

The climate shift towards wetter conditions at the transition from Subboreal to Subatlantic in NW-Europe (ca 850 cal. yrs BC; caused by a decline of solar activity), is also evident in South Siberia. Areas that initially were hostile semi-deserts changed into attractive steppe landscapes with a high biomass production, and therefore high carrying capacity. We focus on south-central Siberia where an acceleration of cultural development and an increase in the density of nomadic Scythian populations took place shortly after 850 BC. We hypothesize a causal relationship between the Scythian expansion and migration, and the early Subatlantic shift towards increased humidity.

Keywords: climate change, solar activity

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INTRODUCTION

During the first millennium BC, Scythian cultures occupied areas from northern China to the Danube River which, nowadays, belong to the steppe and forest-steppe zones of Eurasia. Most of the Scythian sites are located between 42° and 55°N and 30° and 100°E. The origin, evolution, and spread of this nomadic culture is an important issue in archaeology. Radiocarbon dating is increasingly important (Alekseev *et al.*, 2001; Dergachev *et al.*, 2001, Görsdorf *et al.*, 2001), but in many cases radiocarbon dates are lacking, and indirect chronologies still play an important role. The Scythian history can be subdivided into three phases: 1) a pre-Scythian and initial Scythian phase from the 9th to the middle of the 7th century BC; 2) An early Scythian phase from the 7th to the 6th century BC; 3) A third phase - the classical Scythian phase - from the 5th to the 3rd century BC.

A wave of pre-Scythian nomads from the eastern Eurasian steppe zone appeared in the northern Black Sea region during the 9th century BC (Klochko *et al.*, 1997). The most ancient known Scythian monument in Europe (Steblev group barrows, grave 15, located on the right bank of the Dnieper River) has been dated to the 8th century BC. Based on data published by Zaitseva *et al.* (1998), van Geel *et al.* (1998) had previously suggested a link between the migration of Scythians to southeast Europe and climate change, but they assumed that the trigger was an episode of 'extreme climate', without a comprehensive understanding of the triggering (negative or positive) environmental factors. Based on new data, we present the hypothesis that the solar-driven climatic change to wetter conditions was of crucial importance for the cultural blooming and expansion of the Scythian culture.

THE CLIMATIC SHIFT AROUND 850 BC

In northwest Europe, the stratigraphic evidence for a sharp climatic shift during the early first millennium BC to cooler, wetter conditions enabled Blytt and Sernander (Sernander, 1910) to distinguish a (warm, dry) Subboreal and a (cool, wet) Subatlantic period. The climate shift is reflected in the degree of decomposition and species composition of raised bog peat, and it was recently radiocarbon dated (using wiggle-match dating) to ca 850 calendar years (cal) BC. Reduced solar activity appeared to be the cause of the change (Bond *et al.*, 2001; van Geel *et al.*, 1996; 1998; Kilian *et al.*, 1995). The climatic shift was also recorded in the raised bog deposits of Central Europe (Speranza *et al.*, 2002) and had pronounced effects in Eastern Europe, with rapid and total flooding of the Upper Volga region (Gracheva, 2002). Kroonenberg *et al.* (personal communication) recorded a pronounced highstand of the Caspian Sea. The climatic shift in the temperate zone was characterized by enhanced strength of the westerly winds, and probably also by a southwards shift of this west-east circulation (van Geel and Renssen, 1998).

Paleoclimatological studies show that the change in the atmospheric circulation pattern around 850 cal BC also affected southern Siberia and Central Asia. Lake Telmen, Mongolia, has terraces dated between 2710 and 1260 BP, indicating a greater than present-day effective moisture balance (Peck *et al*., 2002). Grunert *et al.* (2000) reconstructed lake-level fluctuations in lakes Uvs Nuur and Bayan Nuur, which are situated just south of the Russian-Mongolian border and only 100 to 200 km southwest of the lowlands in Tuva, an area with an early and rich archaeological evidence for the Scythian cultures (Tagar and Aldy-Bel). A decline of the lake levels of Uvs Nuur and Bayan Nuur occurred from ca 5000 BP onwards, indicating a decrease in precipitation. But a sudden rise of lake levels, combined with glacial readvances, and soliflution started between 3000 and 2000 BP, suggesting enhanced rainfall and lower temperatures. Pollen analysis of a peat deposit showed wetter climatic conditions since ca 2500 BP (Lehmkuhl *et al*., 1998), and a vegetation transition around Bayan Nuur from steppe to a temporary forest.

The pollen record of Kutuzhekovo Lake (southern Siberia, 53º 36’ N, 91º 56’ E) shows the late-Holocene vegetation history (Dirksen *et al*., this volume) of the Minusinsk depression, which is surrounded by the Sajan high-mountain system. The pollen record in the lower part of the diagram points to a dry steppe or even a semi-desert, with open soils and low biomass productivity. A clear transition in the pollen diagram, dated at ca 2800 BP, reflects large-scale environmental changes. The xerophytic taxa show a strong decrease, while moist-demanding taxa show a sharp rise, reflecting a change from a dry to a relatively humid climate. The vegetation changes coincide with a sedimentation change from sandy to predominantly organic lake deposits, an additional indication of a dense vegetation cover in the catchment of the lake (less erosion), probably combined with high local organic productivity in the lake. We conclude that a climatic shift at the Subboreal-Subatlantic transition to cooler, wetter (less dry) climatic conditions also occurred in southern Siberia and Central Asia and the increased precipitation changed an east-west belt of semi-deserts into steppe, with an enhanced vegetation biomass production, and thus with an increased carrying capacity, which was of vital importance for nomadic people.

CULTURAL DEVELOPMENTS IN SOUTHERN SIBERIA AND TUVA

The geographical distribution of the Scythian culture, between 42° and 55°N and 30° and 100°E, is (at present) closely linked with an area of a relatively dry, continental climate with steppe vegetation. We focus on central southern Siberia and Tuva (central Asia). The archaeology of the Minusinsk basin, including both Khakassia and the Krasnoyarsk province north of the Sayan Mountains, differs from that in Tuva which is situated to the south of those areas. Therefore the cultural developments of these areas are discussed separately.

Central Southern Siberia (Minusinsk basin, Khakassia)

The Palaeolithic Aphontovo culture is represented by many sites (Vadeckaya, 1986), but the Mesolithic and Neolithic (8th to 4th millennium BC) are poorly represented (Vasiliev, 2001). Mesolithic-Neolithic sites are found in the present-day taiga and mountain zones and not in the steppe zone. Occupation of the steppe started at the end of the Neolithic period. The Afanasievo (4th to 3rd millennium BC) is the first barrow culture of a europeid population and the easternmost one among the stock-breeding cultures of Eurasia. The Bronze Age starts with the Okunevo culture. The beginning of this culture is dated to the end of the 3rd millennium BC (Görsdorf *et al.*, 1998).

The northern part of the Minusinsk depression was the southernmost region where the Andronovo culture occurred (Middle Bronze Age; 18th to 14th century BC). Compared to neighbouring territories such as Kazakhstan and Western Siberia, a relatively low number of Andronovo sites were found in the Minusinsk hollow. It is difficult to explain why the Andronovo population did not move to the southern part of the Minusinsk hollow, but it may well be that environmental conditions were a limiting factor (see below).

The most represented Late Bronze Age culture in the Minusinsk hollow is the Karasuk culture (14th to 10th century BC) (Bokovenko and Legrand, 2000). Thousands of burial mounds as well as some settlements of this culture were discovered in the steppe zone of the Yenisei River Basin. The local variants of the Karasuk artifacts and their influence were fixed on the huge territory from Central Kazakhstan up to Mongolia and China (Chlenova, 1972, Novgorodova, 1970). The archaeological and osteological material demonstrates that horse-riding became important in this period and the transition to a nomadic stock-breeding economy occurred.

The Karasuk culture developed into the early Iron Age Tagar culture, which is contemporary and closely related to the Scythian cultures in other parts of the Eurasian steppe-belt. The change from the latest phase of the Late Bronze Age to the beginning of the Tagar culture does not represent a break in the cultural development (Leont'ev *et al*., 1996). A long series of radiocarbon dates clearly suggests that the transition from the Late Bronze Age to the Tagar culture should be placed around the 9th century BC (Alekseev *et al*., 2002; Sementsov *et al*., 1997, 1998). In the context of the present paper it is important to note that this fits with the period of evidence for climate change at the Subboreal-Subatlantic transition. However, in the region to the North of the Sayan mountains, no cultural developments point to a causal relationship with climatic change.

The Tagar culture was one of the most pure nomadic cultures, with stock-breeding, complicated burial traditions, weapons, and arts. In the earlier Tagar cultural artifacts, one can recognise elements suggesting both connections with the preceding Karasuk culture, and cultural innovations reflecting contacts with the Kazakhstan-Central Asia region.

Central Asia region (Tuva republic)

Compared to the northern sites, the archaeological evidence from the area south of the Sayan Mountains (Tuva) offers a completely different picture. Palaeolithic sites were located on the banks of Yenisey River and its tributaries (Astakhov and Vasiliev, 2001). Neolithic sites were found only in the Sayan canyon of the Yenisey River (Toora-Dash and Ust'-Khemchik III (Semenov, 1992). At the turn of the 3rd/2nd millennium BC most of these settlements were abandoned and an enormous gap in the prehistory of Tuva follows. It is not known if any cultures spread along the Upper Yenisey River during the first half of the 2nd millennium BC, when the Andronovo culture dominated the Minusinsk hollow. In the second half of the 2nd millennium BC, the situation is little different, especially in the northern and central parts of Tuva. Despite intensive archaeological research, the Karasuk culture of the Late Bronze Age has until now only been represented by isolated finds. This almost complete lack of archaeological records in Tuva is significant.

The situation changed completely after the 9th century BC, when the Scythian culture emerged in Tuva, earlier than in the western parts of the Eurasian steppe zone. The Arzhan-1 barrow yielded very early Scythian material dated to the late 9th/early 8th century BC (Gryaznov, 1984). This early date is confirmed by dendrochronology in combination with ^{14}C wiggle-matching, as well as by archaeological arguments. The immigration and strong increase in human population density of Tuva, soon after the middle of the 9th century BC, had an enormous impact in the whole Eurasian steppe zone. In Tuva the Aldy-Bel culture of the Scythian type emerged earlier than in any other part of the steppe. We suggest that climatic change played an important role in the archaeological development. The coincidence of the sudden transition to less dry conditions (mid 9th century BC) and the population density increase and cultural development in Tuva is significant. Prehistoric communities living in marginal areas of food production may be very sensitive to environmental change, because such changes can have an enormous impact on their way of life. We postulate that the emergence and expansion of the nomadic culture of the early Scythians in Tuva was only possible after a climate shift towards higher humidity (increased plant biomass production and thus a higher carrying capacity). The climatic shift changed Tuva from a dry semi-desert area into a steppe, which was attractive for groups with a nomadic way of life. Similar environmental shifts may have taken place in areas east and west of Tuva, and thus a large east-west situated belt of newly formed steppe vegetation could successfully be invaded.

Van Geel *et al*. (submitted) and Zaitseva (submitted) used the St. Petersburg Radiocarbon Database to compare the geographical distribution and age of the different monuments (2200 14C dates from about 650 sites) in the territory of the Eurasian steppe between 42° and 55° N, and compared the separate dates from southern Siberia (Khakassia) and Central Asia (Tuva) with the complete dataset. Like the archaeological record, the ^{14}C record shows an 'empty' Tuva during the Bronze Age and a sharp increase of its occupation shortly after 3000 BP.

CONCLUSION

A climatic shift towards wetter (less dry) climatic conditions around 850 calendar years BC was responsible for a suddenly increased carrying capacity (higher biomass production) of the Tuva area. We suppose that Tuva was part of a vast, east-west situated belt (the southern part of the temperate climate zone) which - as a consequence of the climate shift - suddenly became available as an attractive living area. The climatic change around 850 cal BC was triggered by a temporary decline of solar activity, and thus we hypothesize that the sun was a major factor, indirectly influencing the cultural blooming and expansion of the Scythian culture.

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REFERENCES

Alekseev A.Y., Bokovenko N.A., Boltrik Y., Chugunov K.V., Cook G., Dergachev V.A., Kovalyukh N., Possnert G., van der Plicht J., Scott E.M., Sementsov A., Skripkin V., Vasiliev S., Zaitseva G. A chronology of the Scythian antiquities of Eurasia based on new archaeological and 14C data. Radiocarbon 2001; 43:1085-1107

Alekseev A.Y., Bokovenko N.A., Boltrik Y., Chugunov K.V., Cook G., Dergachev V.A., Kovaliukh N., Possnert G., van der Plicht J., Scott E.M., Sementsov A., Skripkin V., Vasiliev S., Zaitseva G. Some problems in the study of the chronology of the ancient nomadic cultures in Eurasia (9th-3rd centuries BC). Geochronometria 2002; 21: 143-150

Astakhov S.N., Vasiliev S.A. "The Neolithic-Bronze Age sites in the Sayan canyon of the Yenisei River". In *Eurasia through time*, St. Petersburg, 2001 (in Russian)

Bokovenko N.A., Legrand S. Das karasukzeitliche Gräberfeld Anchil Chon in Chakassien. Eurasia Antiqua 2000; 6: 209-248

Bond G., Kromer B., Beer J., Muscheler R., Evans M.N., Showers W., Hoffmann S., Lotti-Bond R., Hajdas I., Bonani G. Persistent solar influence on North Atlantic climate during the Holocene. Science 2001; 294: 2130-2136

Chlenova N.L. Khronologiya pamytnikov karasukskoy epokhi. MIA 1972; 182 (in Russian)

Dergachev V.A., Vasiliev S.S., Sementsov A.A., Zaitseva G.I., Chugunov K.A., Sljusarenko I.J. Dendrochronology and radiocarbon dating methods in archaeological studies of Scythian sites. Radiocarbon 2001; 43: 417-424

Görsdorf J., Parzinger H., Nagler A., Leontev N. Neue 14C-datierungen für die sibirische Steppe und ihre Konsequenzen für die regionale Bronzezeitchronologie. Eurasia Antiqua 1998; 4: 73-80

Görsdorf J., Parzinger H., Nagler A. New radiocarbon dates of the north Asian steppe zone and its consequences for the chronology. Radiocarbon 2001; 43: 1115-1120

Gracheva R. Abrupt environmental change and depopulation of Upper Volga lowland, Central Russia, around 2,600 BP. Abstr. Conf. Environmental catastrophes and recoveries in the Holocene, Brunel University, UK (2002). http://atlas-conferences.com/cgi-bin/abstract/caiq-71

Grunert J., Lehmkuhl F., Walther M. Paleoclimatic evolution of the Uvs Nuur basin and adjacent areas (Western Mongolia). Quaternary International 2000; 65/66: 171-192.

Gryaznov, M.P., *Arzhan*. Leningrad: NAUKA, 1980 (in Russian)

Gryaznov M.P., Der Großkurgan von Arzhan in Tuva, Südsibirien. Materialien zur Allgemeinen und Vergleichenden Archäologie 23. München: Verlag C.H. Beck, 1984.

Kilian M.R., van der Plicht J., van Geel B. Dating raised bogs: new aspects of AMS 14C wiggle matching, a reservoir effect and climatic change. Quaternary Science Reviews 1995; 14: 959-966

Klochko V.I., Kovalyukh N.N., Skripkin V., Motzenbecker I. Isotope chronology of the Subotiv settlement. Radiocarbon 1997; 40: 667-673

Lehmkuhl F., Schlütz F., Beckert C., Klinge M. Zur jungpleistozänen und holozänen Klimageschichte des Turgen-Charichira, Mongolischer Altai. Jenaer Geographische Manuscripte 1998; 19: 43-44

Leont'ev N., Parzinger H., Nagler A. Die russisch-deutschen Ausgrabungen beim Berg Suchanicha am mittleren Enisej. Eurasia Antiqua 1996; 2: 175-204

Novgorodova E.A. Centralnaya Asiya i karasukskaya problema, 1970 (in Russian)

Peck J.A., Khosbayar P., Fowell S.J., Pearce R.B., Ariunbileg S., Hansen B.C.S., Soninkhishig N. Mid to Late Holocene climate change in north central Mongolia as recorded in the sediments of lake Telmen. Palaeogeography, Palaeoclimatology, Palaeoecology 2002; 183: 135-153

Semenov V.A. The Neolithic-Bronze Age in Tuva, St. Petersburg. 1992 (in Russian)

Sementsov A.A., Zaitseva G.I., Görsdorf J., Nagler A., Parzinger H., Bokovenko N.A., Chugunov K.V., Lebedeva L.M. Chronology of the burial finds from Scythian monuments in Southern Siberia and Central Asia. Radiocarbon 1998; 40: 713-720

Sementsov A.A., Zaitseva G.I., Görsdorf J., Bokovenko N.A., Parzinger H., Nagler A., Chugunov K.V., Lebedeva L.M. The chronological questions of the Scythian nomads for the Southern Siberia and Central Asia region, Radiocarbon and Archaeology 1997; 2: 86-94 (in Russian)

Sernander R., *Die schwedischen Torfmoore als Zeugen postglazialer Klimaschwankungen. Die Veränderungen des Klimas seit dem Maximum der Letzten Eiszeit*. Stockholm, 1910.

Speranza A., van Geel B., van der Plicht J. Evidence for solar forcing of climate change at ca. 850 cal BC from a Czech peat sequence. Global and Planetary Change 2002; 35: 51-65

Vadeckaya E.B., *Archaeological monuments in the steppes of the Middle Yenisei river Basin*. Leningrad, 1986 (in Russian)

van Geel B., Renssen H. "Abrupt climate change around 2,650 BP in North-West Europe: evidence for climatic teleconnections and a tentative explanation." In *Water, Environment and Society in Times of Climatic Change*, A. S. Issar, N. Brown, eds. Dordrecht, Kluwer Academic Publishers, 1998.

van Geel B., Buurman J., Waterbolk H.T. Archaeological and palaeoecological indications for an abrupt climate change in The Netherlands and evidence for climatological teleconnections around 2650 BP. Journal of Quaternary Science 1996: 11: 451-460

van Geel B., van der Plicht J., Kilian M.R., Klaver E.R., Kouwenberg J.H.M., Renssen H., Reynaud-Farrera I., Waterbolk H.T. The sharp rise of delta 14C ca. 800 cal BC: possible causes, related climatic teleconnections and the impact on human environments. Radiocarbon 1998; 40: 535-550

van Geel B., Bokovenko N.A., Burova N.D., Chugunov K.V., Dergachev V.A. Dirksen V.G., Kulkova M., Nagler A., Parzinger H., van der Plicht J., Vasiliev S.S., Zaitseva G.I. Climate change and the expansion of the Scythian culture after 850 BC, a hypothesis. Submitted to Journal of Archaeological Science.

Vasiliev S.A. The late complexes of the multilayer site Ui-II and the problem of the development of the holocene Stone Age cultures in the Upper Yenisey River Basin. Archaeological News 2001; 8: 62-76

Zaitseva G.I., Possnert, G., Alekseev A.Y., Sementsov A.A., Dergachev V.A. The first 14C dating of monuments in European Scythia. Radiocarbon 1998; 40: 767-774

Zaitseva G.I., van Geel B., Bokovenko N.A., Chugunov K.V., Dergachev V.A., Dirksen V.G., Koulkova M.A., Nagler A., Parzinger H., van der Plicht J., Bourova N.D., Lebedeva L.M. Chronology and possible links between climatic and cultural change during the first millennium BC in Southern Siberia and Central Asia. Submitted to Radiocarbon.