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Plenary Agenda Report for Research Group A-II

Spatial Effects of Technological Innovations and Changing Ways of Life

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Abstract: Research Group A-II is concerned with the interdependency of technological and social change and with the dynamics of human-environment interaction. The focus is on investigations of the genesis of spatially-relevant inventions and on those having an impact on spatiality (ceramics production, domestication of animals, early wheel and carriage technologies, draft and herd animals, equestrian nomadism), and on the mechanisms through which such innovations were diffused. In this context, the aim is to determine the extent to which central aspects of spatial and social mobility may be regarded on the one hand as the consequences of specific technological innovations, and on the other as preconditions for the dissemination of innovation. Moreover, the far-reaching impact of technological innovation on demographic, societal, economic, and spatial parameters is investigated in the framework of various projects and at a number of different locations in the Eurasian steppes and in Central Asia. Deployed are both archaeological excavations with the enlistment of natural-scientific procedures from the areas of geophysics, archaeozoology, paleoethnobotany, pedology, and geomorphology, as well as pure laboratory analyses of human and animal teeth and bones for the sake of compiling isotope/chemical data. The theoretical foundations of the discussions of this research group have been and remain in particular the central concepts of innovation, mobility, and knowledge.

Projects:
- »Spatially Effective Innovation and Mobile Ways of Life in the Northern Pontic Region (3500–2000 BCE)« (Subproject, Wolfram Schier)
- »Mobility and Innovation in Semirechye during the 1st Millennium BCE« (Subproject, Hermann Parzinger)
- »The Localization of Innovation in Prehistoric Southern Turkmenistan« (Subproject, Reinhard Bernbeck, Svend Hansen, Susan Pollock)

Contents

1 The Three Thematic Complexes: Innovation, Mobility, and Knowledge

This introduction attempts to provide a programmatic overview of the thematic fields around which all of the endeavors of Research Area A-II are organized. We begin by providing definitions of the three central concepts or constellations of concepts which reflect the discussions currently taking place in our research group.

The first designated theme – one referred to already in the title of our research group – is innovation, or more concretely: the processes of innovation that are to be investigated for prehistoric periods. Innovation emerges through the integration into an existing society of ideas, practices, and objects which have appeared for the first time in a given region (cf. BURMEISTER forthcoming). The concept of »innovation« is to be clearly distinguished from the »new« and from »invention«: an invention represents only a potential, and opportunity for innovation. Only through its adoption by a society does such a potential result in innovation. Consistently discoverable behind a given innovation, then, is a societal, historically graspable process, one whose localization within sociohistoric change must be specified with precision. Innovation is not necessarily the engine of societal transformation, but may also represent an integrated aspect of processes of change which are already in progress.

Archaeologically, we attempt not only to document the progression of a successful *innovation*, but also its dissemination into other regions beyond the center where it initially became coherent and effective. For preliterate cultures, the dissemination of innovation can only be substantiated when a temporal delay intervenes between its emergence at the center and its implementation at other locations, so that a temporal gradient is measurable in the first place. Secondly, the spatial dimension must be investigated as well. The range and pace of dissemination can be ascertained in particular when there exists an adequate basis for dating, and where the respective cultural contact has been documented. In order to integrate data about the intensity of innovation as a third factor into the dissemination of innovation, thirdly, the density of innovative elements must be determined as well. Fourth, for an innovation to be adopted and implemented, it is not enough – as mentioned above – to document the mere transfer to a different cultural realm; instead, specific economic, environmental, and societal preconditions must have existed which were capable of affecting the acceptance of the ›new.‹ This acceptance cannot be interpreted as a decontextualized addition to a pre-existing cultural and praxological inventory; analyzed instead must be an innovation's incorporation into an existing cultural network – which may even entail its becoming divested entirely of its original ›meaning.‹

The spatial dimension leads to the second thematic complex of A-II. *Mobility* fosters the dissemination of innovation, but may also be its outcome: where the means of mobility or of mobility-relevant technologies (the wheel, riding or draft animals, the maintenance of herds) are diffused, the aim of the innovation (for example the dissemination of the wheel) and its medium (the vehicle, for example) may coincide; emerging now is a positive feedback process. If we want to avoid assuming the presence of a pure migration of ideas through which an innovation is transferred from its original location to other cultural region by means of an intermediary, but in the absence of an extended period of intercultural contact, then a multiplicity of forms of mobility must be discussed which effect corresponding forms of exchange. We must distinguish between the movements of isolated individuals on the one hand and entire groups on the other. In the latter case,

we must differentiate between cyclical mobility (WENDRICH – BARNARD 2008) and unidirectional migration (PRIEN 2005), i.e. involving the irreversible and purposeful movement of the majority of a given population. This must not necessarily involve a one-time mass movement; a more realistic historical scenario might involve the protracted influx of migrants which coincides with the return of portions of the migrating group (»return migration« cf. BURMEISTER 2000, 544). Cyclical mobility, on the other hand, is a feature of a continuous way of life; in extreme cases, all segments of a population lead a wandering existence as nomads. Located between permanent settlement and nomadism are a series of intermediate stages, many of which exist in interdependency with specific forms of subsistence. We can almost assume that precisely the temporal dimension of mobility, that is to say its rhythms/frequency, is not confined to archaeologically detectable, short-term movements, but must also incorporate mid-term forms of mobility, for example (i.e. those lasting at least one generation, etc.) as well. Needless to say, all of the above-named facets of mobility involve a strongly social dimension.

Processes of innovation are based on transfers of knowledge – and this last category forms our third basic thematic complex. A variety of categories of *knowledge* (even if these do not exist in a pure form) are significant for its spatial effectivity. In most instances, *discursive* knowledge (LAM 2000) is institutionalized and transmitted as pure information. Such transmission may be effected other orally or through textual or image media, with externally stored knowledge remaining more easily accessible to archaeologists. *Embodied* knowledge (CSORDAS 1990; VAN WOLPUTTE 2004), on the other hand, is as a rule transferred mimetically, which implies the more extended temporality of observation, practice, and the constant repetition of relevant practices. It can be assumed, therefore, that transfers of embodied knowledge are possible only within structures of mobility which bring together groups or individuals for specific intervals. The sole exception would be the transfer of embodied knowledge that has been strongly reshaped discursively, and which consists of verbal instructions designed to accompany body movements.

This delineation of the conceptual state of the discussion is the result of an intensive preoccupation with the three central thematic complexes of Research Group A-II. An important contentual advance was generated by the interdisciplinary workshop »Mobility and the Transfer of Knowledge,« which took place in December of 2009 with the active involvement of numerous Topoi members. At this meeting, the concepts of knowledge, mobility, and innovation were discussed in sequence from cultural-historical, technological, and economic perspectives. The results of the workshops will be appearing shortly in the publication series of this Excellence Cluster.

2 Initial Results of the Three Projects

Presented in the following, and in extension from the programmatic level, are the initial results of the three endeavors which comprise our research group, each of which is devoted to investigating spatially-effective and space-related innovation in various territories and periods.

The projects being carried out under the direction of principal investigators Hermann Parzinger and Wolfram Schier form two interdependent parts, both launched in 2008, while the project of principal investigators Susan Pollock, Svend Hansen, and Reinhard Bernbeck was originated only recently.

2.1 Spatially Effective Innovations and Mobile Ways of Life in the Northern Pontic Region (3500–2000 BCE), subproject, Wolfram Schier

The subproject of W. Schier – which takes the form of a purely analytical project – focuses on the northern Black Sea region and adjacent regions in the period between 3500 and 2000 cal BCE. During this period, lasting 1.5 millennia, the Northern Pontic steppe region was settled by at least three different cultures, each of which left behind archaeological traces, primarily in the form of grave finds. Found alongside thousands of grave mounds are a few dozen small settlements, while the spectrum of animal bone finds documents the transition to livestock breeding based on cattle around 3000 cal BCE. Coinciding more-or-less with this shift in the subsistence economy is a new, homogeneous construction in the grave mounds, one not restricted to the eastern European steppes, but extending as far as the Carpatian-Balkan region. These graves constructions, unusual for southeastern Europe, are generally regarded as the consequence of emigration from the steppes region, although we can only speculate about the population magnitude of the emigrants and their impact on the indigenous population of the target region.

With regard to migration, archaeological arguments have been supplanted in this instance (KAISER 2010). From the perspective of theories of knowledge, we can adduce that interment practices belong at least partially to the category of *embodied knowledge*, so that their dissemination in a foreign territory testifies to extended contacts with the populations of the steppes region. The application of isotope analysis promises to yield new information. The investigation of certain isotopes permits us to draw conclusions about forms of mobility in the population of the steppes. The isotope values of $^{87/86}$strontium and ^{18}oxygen are measured in human teeth in order to determine whether an individual migrated after reaching adulthood or instead took up a new place of residence already in childhood. Livestock breeding based on cattle, whose inception apparently lies around 3000 cal BCE, represents a striking specialization of subsistence activity, one that resulted from processes of innovation, and is moreover often seen as effective only in the form of mobile pasture farming. Accordingly, it should be possible to document changes occurring around 3000 cal BCE in the isotope ratios of the remains of individuals from the grave mounds of a specific locality. Hitherto available strontium isotope ratios for a variety of grave mounds necropolises in sites located in what is now Hungary, Bulgaria, and the Ukraine, as well as Russia, yield a variety of patterns of mobility for individuals who were interred in these localities. Presented here for the sake of clarity are

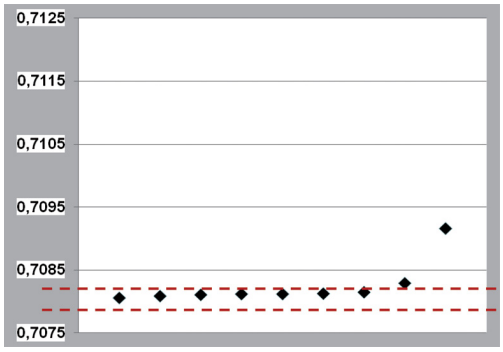

Fig. 1a | $^{87}Sr/^{86}Sr$ values for human remains from the burial mound near the village of Benkovski, Bulgaria.

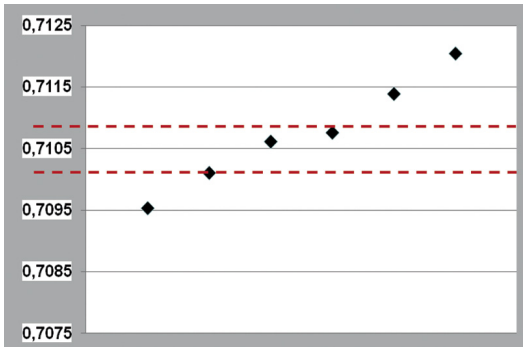

Fig. 1b | $^{87}Sr/^{86}Sr$ values for human remains from the burial mound in the town of Kirovohrad, Ukraine.

two examples from the necropolises of Benkovski in Bulgaria and a grave mound in the Ukrainian town of Kirovohrad (Figs. 1a–b). Local values for both sites are indicated by dotted red lines; the signs found outside of these areas represent individuals having non-local strontium isotope values.

Recent research on isotope ratios demonstrates that they can be strongly influenced by climatic conditions. Moreover, the transition to specialized, mobile livestock breeding can be explained by climate fluctuations and changes in paleolandscapes. In an initial pilot study, Janina Körper of Research Group A-III (*Archaeometry – Archaeoinformatics*) simulated precipitation magnitudes and temperatures for the western Eurasian region between 6000 BP and 2000 BP. The first and most striking result of these simulations was a distinct caesura occurring around 5200 BP, i.e. coinciding with the period of a gradual transition to specialized livestock breeding. Further research is required to determine whether such changes, in particular those involving precipitation, could have this type of impact on human subsistence economies. Complementing this effort, and in collaboration with a doctoral candidate of Frau Schütt, proxy data are being compiled for a paleolandscape reconstruction of western Eurasia.

2.2 Mobility and Innovation in Semirechye during the 1st Millennium BCE, subproject, Hermann Parzinger

A number of the aspects mentioned above are also significant for the second subproject, directed by H. Parzinger, which deals with the space-dependent settlement behavior of human communities in Semirechye, located in contemporary Kazakhstan, during the later 2nd to 1st millennia BCE. It is a question here of one of the most important regions for archaeological finds in the Eurasian steppe belt, with countless sites containing remains from equestrian nomad groups of the Scythian epoch (the so-called Sakas). Today, only a small number among thousands of grave mounds have been investigated, and these involve older excavations exclusively. The process of settlement of Semirechye beginning in the early 1st millennium BCE is associated with fundamental changes in all areas of life: during the 2nd millennium BCE, hitherto sedentary populations became mobile, economic modes and forms of life were transformed, and entirely new territories explored and occupied or restructured in wholly novel ways. Occurring at the same time were close contacts between the cultures of this region and those of Iran and northwestern China, from which a northern stretch of the Silk Route would evolve in the subsequent period.

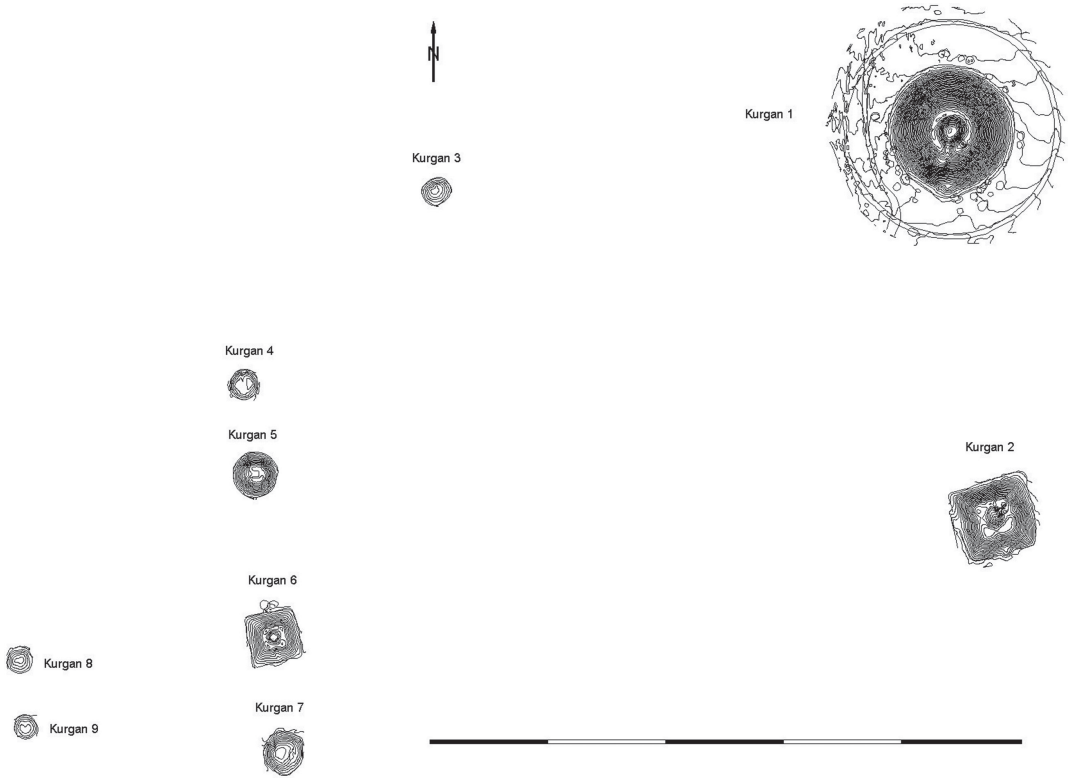

Fig. 2 | Plan of the Scythian burial mound necropolis at Žuan-Tobe, Kazakhstan.

Emerging as a consequence of these upheavals during the 1st millennium BCE were the equestrian nomadic cultures which would profoundly shape political, economic, and cultural events in the European steppe belt during the ensuing millennia. These formation of such equestrian cultures were accompanied by innovations that would engender transformations in societal structures, economic modes, and combat and riding technologies. We know that this process of transformation had its inception in the late 9th and 8th centuries BCE in parts of southern Siberia before obtruding later into the temporal horizon of the eastern and southern parts of Kazakhstan, the region lying at the heart of this subproject. The aims of this subproject are:

1. to define with greater precision the moment when this process of transformation began to affect the above-named parts of Kazakhstan (Semirechye, but also the western foothills of the Altai region);
2. to investigate its causes in greater detail;
3. to investigate the trajectories and forms of dissemination of the innovations associated with it;
4. to examine the effects of this transformation on the utilization and structuring of space.

Given the unsatisfactory state of research with regard to the area of investigation, which has for the most part left an extensive white patch on the archaeological map of Eurasia, this subproject is also undertaking targeted conventional and geophysical photography of excavation sites, as well as excavations, in order to improve our understanding of the constitution and structure of the necropolises of this period (cf. Fig. 2). The results of this exemplary fieldwork also flows into the investigations of one tandem of Research Group A-I *Central Places and Their Environment* (consisting of doctoral candidates Mark Blättermann and Anton Gass), with its orientation to prehistory and geoarchaeology, which is

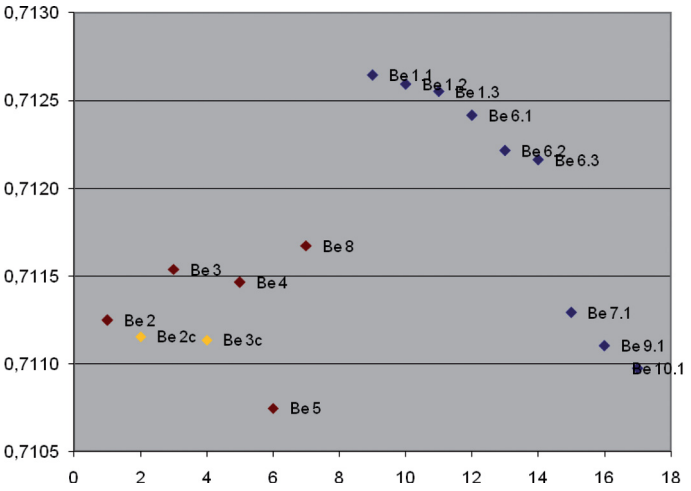

Fig. 3 | $^{87}Sr/^{86}Sr$ values for human remains (red and yellow signs) and horse remains (blue signs) from graves of the necropolis at Berel, Kazakhstan.

devoted to investigating first Late Bronze and Early Iron Age settlement history and space utilization in Semirechye in southeastern Kazakhstan, and secondly, the transformations of landscape and climate during the same period. It has already become clear that the fundamental shift from sedentary farming and livestock breeding to the almost exclusive dominance of equestrian nomadic cultures was associated with climatic changes which also had a long-range impact on vegetation and the environment. These changes favored or even compelled the adoption of innovations by the equestrian nomadic cultures which had already become dominant further to the east under comparable conditions.

Ultimately (and in ways comparable to the situation of the first subproject), strontium isotope analyses are an indispensable tool for bringing us closer to resolving the question of the degree to which these climatic conditions led to migrations, and the question of the actual degree of mobility of these populations during this period. The process of sample collection has already been concluded, and will facilitate our attempts to compare the foreign neighboring regions: Semirechye, Altai, the Minusinsk Basin, and Tuva; work on the samples is already underway. Conducted in the framework of research group A-II will be isotope/chemical investigations (see above, first subproject), to the extent possible at the same sites. Already diagnosed has been an extremely interesting find for the site Berel in eastern Kazakhstan: it has been shown that during their lifetimes, the horses of this region had a markedly greater radius of mobility then the region's people during the same period (Fig. 3). It will be exciting to see how other sites and subregions will relate to this discovery.

2.3 The Localization of Innovation in Prehistoric Southern Turkmenistan, subproject, Susan Pollock, Svend Hansen, and Reinhard Bernbeck

The third project, directed by S. Pollock, S. Hansen, and R. Bernbeck and initiated in early 2010, investigates the localization of prehistoric innovations in contemporary southern Turkmenistan. Defined as local context is the social and spatial integration of primary technological innovations. Excavations are necessary for this; the first of those took place this summer.

The project on Monjukli Depe, located on the northern edge of Kopet Dag on an alluvial fan in the vicinity of Meana in Turkmenistan, investigates a late Neolithic/early Chalcolithic

Fig. 4a | Architectural trench B: Anau IA period (Chalcolithic era).

Fig. 4b | Two houses from the Anau IA period in trench C.

site that was excavated by Soviet archaeologists more than 50 years ago (Figs. 4a–b). Utilized are a number of natural-scientific methods of analysis, none of which were used during the period of the Soviet-era excavations. The period of the 6th to the 4th millennia BCE in southern Turkmenistan is the period when agriculture and livestock breeding, and subsequently ceramics production and metallurgy, were practiced for the first time in Central Asia.

Examined with special intensity among the thematic fields sketched above (Section 1) are the following questions:

1. How were innovations such as agricultural technologies – which must be conceptualized as larger clusters of activities – transferred from one settlement grouping to the next? Were short-term contacts sufficient, or did such innovations proceed via long-range migrations?

2. For the mobility scenarios we are attempting to specify, a variety of questions are initially pertinent. In cases of immigration, it must be determined whether the

technologies brought by the new arrivals were adapted to the requirements of the new location. Posing itself with regard to the local reception of alien technologies is the question of the motivations which led to their adoption. Did this take place through the transfer of technical knowledge? Or were mimetic, step-by-step forms of imitation decisive instead? And were such technologies adopted *tout court*, or were they instead modified?

Initial results, arrived at during a one-month excavation that took place in summer 2010, have suggested unexpected innovation processes. To begin with, it became obvious that – contrary to the account given by the Soviet excavators – a break in settlement history intervened between the late Neolithic and early Chalcolithic eras, ones whose duration and causation have yet to be investigated (Figs. 4a–b). Traces of the earlier Neolithic era could be documented only at a few locations, but did display a standard assemblage containing unpainted pottery, stone implements and figurines of the kind typical of the Jeitun Culture, and quite familiar from earlier excavations. During the transition to the Chalcolithic era, pottery disappeared almost entirely. It is astonishing, moreover, that the few Chalcolithic sherds found were qualitatively superior (Fig. 5) to those of the Neolithic era, and can be reassembled into nearly complete ceramic vessels. At least initially, this indicates that the number of pottery vessels present in later strata must have been very low. Provisionally, we can conclude that Monjukli Depe is a location where, after a hiatus, and in the context of the abandonment and resettlement of an extensive area, the innovative production of pottery was no longer regarded as necessary. The same is true of lithic implements. It will therefore be necessary to devote exacting consideration to the human-environment relationship at Monjukli Depe. Were there alternative materials for the production of vessels, perhaps ones that have not survived? If so, might we succeed in discovering the production instruments for such objects, for instance lithic scrapers, drills, etc.? Clarification is urgently required here, but is achievable only through the conjunction of the topics of mobility, innovation, and knowledge; an assessment of object density may be useful alongside natural-scientific analyses of bones, plant remains, and soil samples. Planned for 2011 as well is a survey of the vicinity of Monjukli Depe.

Fig. 5 | Ceramics from the Anau IA period.

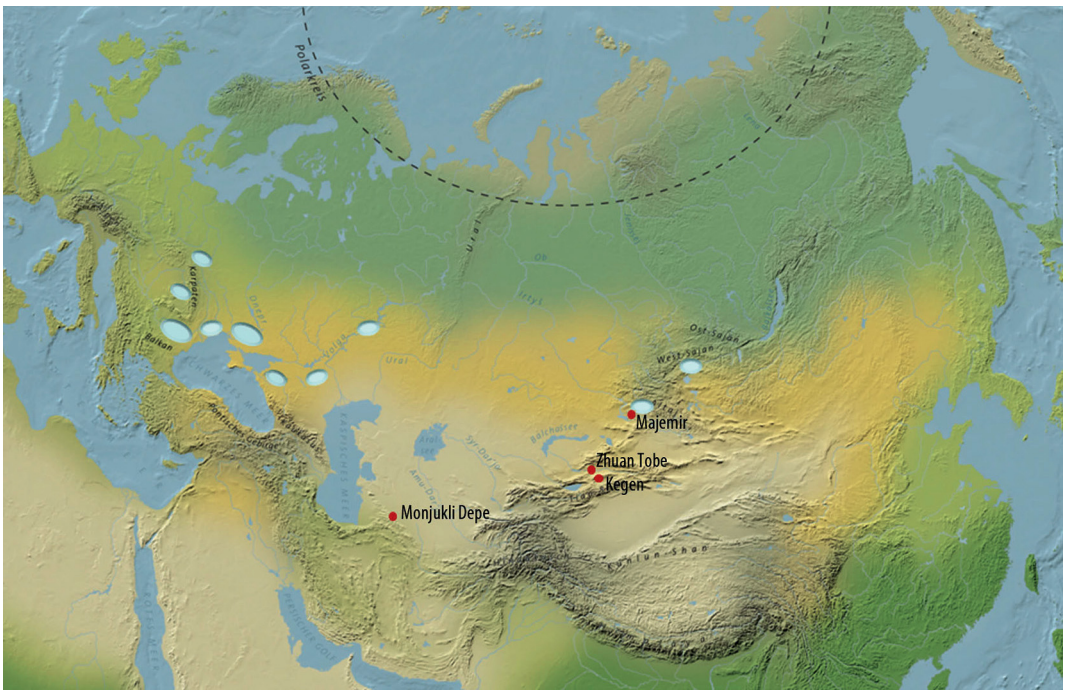

Fig. 6 | Geographic locations of the sites investigated by Research Group A-II:
red: excavations; pale blue: sampled find regions.

3 Résumé

Each of the projects presented above is dedicated to a contrastive and comparative approach to the processes of innovation, their preconditions, and consequences, with special attention to mobility and the dissemination of knowledge. Under investigation – as elaborated above – are large and varied landscapes in Eurasia during a period lasting 5000 years in a number of different time slices, as well as various realms of the prehistoric lifeworld (Fig. 6). Referred to frequently in the preceding discussion too were established designations for archaeological cultures. These were not applied in an unreflective manner, i.e. as factual classifications, but were instead interrogated critically in the framework of an attempt to come to terms with this thematic area as a whole. In this context, Research Group A-II is directly affiliated with CSG V (*Space and Collective Identities*), which is devoted to the aspect of identity. Several participants in A-II are also members of Research Group CSG V.

Perspectives for future research will be generated by the definitive conclusion of our comprehensive evaluation of the informational potential of all natural-scientific procedures and archaeological operations. At this point, it is possible to assert that our continuing investigations will be characterizable in terms of a »political ecology of non-sedentary peoples.« Circumscribed by this term are three different issues:

1. The cultural-political dimension of the utilization of natural space: to begin with, our investigations are geared toward the natural-scientific analysis of human-environment relationships in non-sedentary societies. Such relationships never consist purely of adaptive processes, but instead involve perceptions and conceptions of the environment. To be determined here are the selection and non-use respectively of specific natural resources, both to be analyzed in terms of the symbolic dimension.

2. Such selective praxis in the human-environment relationship is strongly dependent upon technology, so that the pace of development and the dissemination of certain technologies can provide insight into the world of knowledge and ideas standing behind them. Here, the assumption that adaptation and technology stand in an optimal relationship to one another is consciously rejected. Human beings constitute their environments, just as, conversely, their environments constitutes them.

3. To this context belongs the dimension of intersubjective relationships. As a rule, mobile groups – like sedentary ones – display internal power asymmetries which have an immediate impact on the shaping of the environment – whether it is a question of a preference for a certain domesticated animal (the horse, for example), of the delimitation or subdivision of households, or of spectacular burial structures intended for individuals.

The participating researchers, then, plan to extend their confrontation with the nexus formed by mobility, technological innovation, and knowledge. In the future, however, these three elements will be configured more emphatically into relationship with societal power differentials and structural transformations.

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6 Figure Source

Fig.1a–b, 3: Claudia Gerling • Fig. 2: Jan Voigtländer • Fig. 4a–b, 5: Reinhard Bernbeck, Susan Pollock • Fig. 6: Doris Bordon, Elke Kaiser (caption).

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