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Theoretical Background and Introduction to the Question

Images of the Last Ice Age always attract us to imagine and explore – just recall how many movies on the Ice Age we have watched. *Ice Age* (2002) provides a vivid image of what the Last Glacial Maximum looks like – mammoths and sabretooths as well as humans migrated for food, while *Ice Age: The Meltdown* (2006) is about the end of the Ice Age, in more scientific term, the Pleistocene-Holocene transition. *Alpha* (2018) refers to the domestication of dog (then named as Alpha) during the Late Pleistocene, which was one of the greatest technological leaps in the human history.

The most abundant evidence of human evolution comes from stone tools. The leading role Keda in the movie *Alpha* got his diploma – making a perfect symmetric Solutrean point – before he was certified to be a member of bison hunting team, showing the significance of lithic technology in prehistoric foraging societies. Ironically, studying lithic technology is a "helpless" choice, since very few organic artifacts associated with technology in the past have survived. No doubt, Keda used a spear rather than just a stone point in hand to hunt bison and/or to protect himself, the shaft can only be seen unless in the extraordinary conditions suitable for the preservation of the organic components. This is a question about decay of materials and taphonomic issue, while even if everything was preserved, it is also a challenge to know what happened in the past. This is the big gap between archaeological record in the present and human behaviors in the past, and one of the central goals of archaeologists is to build a bridge strong enough to firmly link them. Lewis Binford, one of the most influential archaeologists in the history calls it the Middle-Range Theory. The study of lithic technology is a part of this work, especially for the Stone Age archaeology.

This monograph focuses on the NE Asia, another side of Eurasia where the dog Alpha and the hunter Keda lived (and might be west to the movie *Ice Age*, since the illustration tending to be about North America). During the Last Ice Age, NE Asia tends to be the mammoth steppe or dry steppes according to current paleoclimatic studies. One of the most prominent lithic technologies adopted by the people is microblade technology, using small-size stone blades to inlay organic tools. In this chapter, I will outline the current theory building on lithic analysis first, and then suggest a paleosociological research strategy, which the monograph tends to adopt. The concept "microblade-based societies" are used to learn the lifeways of prehistoric hunter-gatherers who equipped with microblade technology as weaponry. Finally, the framework of the monograph will be shortly introduced.

1.1. Current Theories for the Study of Lithic Technology

Archaeology is the study of people-things relationships, with three dimensions: time, space, and form (see Spaulding 1960). Relationships of hunter-gatherers and lithic artifacts with the three dimensions can be displayed in the scheme as below (Table 1.1). Theory building work of lithic analysis can be seen as the exploration of the complicated relationships between dimensions of agents who leaving the things behind them and of (by-)products of agents' behaviors and/or other forces (natural or cultural). Beginning with the birth of archaeology as a discipline, scholars have been devoting themselves on decoding the archaeological record (things) and building reliable link between human behaviors and properties of things.

It is noted that mobility of the hunter-gatherers plays a key role to understand the dimensions of lithics seen in the archaeological assemblages. Lithics as well as other artifacts can be seen as products or byproducts of the operation of prehistoric foraging cultural system. The mobile lifeway of hunter-gatherers, at present or past, would produce different forms of artifacts with different temporo-spatial distributional patterns. Assuming that people-things relationship can be regarded as learning strategy for archaeologists to understand dynamics of technological change and cultural change in general, two different but not exclusive research strategies can be identified.

If we make inferences of people from things, the reasoning process would be mainly pattern recognition of archaeological record, which provides clues to know what happened regarding the people. Archaeologists have done this kind of work since early archaeology during the era of the Three Age Systems. With the help of typology and seriation, time can be measured, and combining with information of spatial distribution, form of artifacts can be studied under the concept of "archaeological culture" or

Table 1.1. People-things relationship with three dimensions

	People	Things
Time	Life span of hunter-gatherers and nature of tasks	Life cycle of lithic artifacts
Space	Mobile scale or territory of hunter-gatherers	Distribution of lithic artifacts
Form	Social organization of hunter-gatherers	Physical and chemical properties of lithic artifacts

"complex", which might refer to specific ethnic groups. Archaeologists gradually realize that form of an artifact might change from the time when it is manufactured to the time when it is discard and gets deposited, which happens to lithic artifacts easily, for example, a long scraper can be transformed to a short one after days and days of use and resharpen (see Dibble 1995). Now, static typology has been partly replaced by dynamic typology, especially in the realm of lithic analysis. One of the greatest advance is the use of the term *chaîne opératoire*, a word borrowed from French ethnology, to deal with the questions on stages of tool making and on the decision making process of the tool maker. It has an American parallel – Schiffer's behavioral chain and life cycle of artifacts (Sellet 1993, see Schiffer 1972) or the American reduction sequence (Shott, 2003). Compelling definitions of Perlès (1987) and Sellet (1993), as well as Bar-Yosef and Van Peer (2009), the lithic *chaîne opératoire* can be defined as

> succession of mental operations and technological gestures applied on stones, in order to satisfy a need (immediate or not) in the prehistoric knapper's mind on using practical skills for an overall technology (according to a preexisting project), aiming to describe and understand all cultural transformations that lithic raw material had to go through, including raw material procurement, reduction sequences, use, maintenance and discard.

The concept *chaîne opératoire* greatly expands the realm of the previous typological approach, since it not only emphasizes process of lithic reduction and thereby embraces debris and failures as well as finished tools, but also explicitly extends to tool use and discard processes (Shott 2003).

Another approach comes from the opposite direction – from people to things. The reasoning process much looks like deduction, rather than induction, since the distribution of properties of archaeological record is assumed to be (by-)products of the dynamics of human activities. To understand the variability of lithic artifacts, it is necessary to know the lifeways of the hunter-gatherers who procured, made, used, and discarded them. Most of this work is done by ethnoarchaeologists who systematically examine and document living groups of people to discern connections between specific activities and the things left behind, helping archaeologists make defensible inferences of vivid and dynamic human behaviors from unspoken and static artifacts. In the realm of lithic studies, it is the research of lithic technological organization. Lewis Binford is the person who first explicitly proposed this kind of approach. Based on his ethnoarchaeological work in the Nunamiut Eskimos, Binford (1973, 1977, 1979) did a great deal of observation and conducted a series of research on technological organization, especially proposed the division of curated and expedient lithic technology. Curated technology is highly organized, producing formal tools, while the expedient technology is poorly organized, producing informal tools. Just as Binford (1977:34) argued, "[i]mportant items are maintained and curated, thus their entry into the archaeological record, in terms of frequency, is inversely proportional to the level of maintenance and hence their technological importance, other things being equal". Because of the difference in investment, the "important" artifacts should show different distributional and formal patterns comparing with those of the less important ones, which suggests that behavioral patterns behind the production and use of the items are different. Then, based on the comparison of subsistence-settlement systems between the Kalahari San and Alaska Nunamiut patterns of mobility and subsistence, Binford (1980) distinguished foragers from the collectors, corresponding to residential (move people to food) and logistical (move food to people) movements. Clive Gamble (1999: Table 1.3) suggests that a correspondence exists between curated and expedient technologies and logistical and residential movement patterns, as well as reliable and maintainable technologies identified by Bleed (1986). The study of technological organization was then used to study factors leading to interassemblage variability, such as raw-material availability (Andrefsky 1994), weight for carrying (Kuhn 1994), technological efficiency (Bamforth 1986, Jennings, Pevny, and Dickens 2010), settlement mobility (Shott 1986), land use patterns (Bamforth 1991), and even mating strategies (MacDonald 1999).

The two approaches mentioned above have broader evolutionary and ecological significance. The things-people reasoning follows an evolutionary approach, which has been developed from cultural-historical studies associated with lithic assemblage with the help of Darwinian evolution (Andrefsky and Goodale 2015). Formal types of lithic artifacts have potential to integrate stone tool analysis within the evolutionary framework of selectionism and tend to adopt the phylogenetic analysis known as cladistics. This kind of research has been popularized in the Paleolithic (also termed Paleoindian and Paleoamerican) archaeology in the North America. Spread of specific lithic artifact types, for instance, projectile points (Lyman and O'Brien, 2000), is especially suitable for this kind of approach, since these formal and standardized artifacts with a relatively narrow range of design can be regarded as biological species which can evolve from one form to another. Cladistics and other methods on the project points have been applied to study the peopling of North America (Buchanan and Collard 2007, 2008; Buchanan and Hamilton 2009), as well as the Paleoindian-Archaic technological transition (Darwent and O'Brien 2006; O'Brien, Darwent, and Lyman, 2001). The strength of the cladistics and morphometric studies is questioned by Shott (2015). He argues that current research describing material record, using it to measure time to construct static, homogenizing scenarios of the past, and limiting the explanations of change in material culture (its mode, rate, and cause) is not enough to build a body of theory on cultural change. According to Shott's suggestions, the changes in projectile points should be explained as a result of multiple processes, including use, functional requirements, human situational needs,

etc. (see Andrefsky and Goodale 2015), which implies that variability of lithics cannot be effectively explained unless against a broader background of various behaviors of foraging societies.

To the contrary, the people-things reasoning follows an ecological approach, which is closely related to processual archaeology under the background of functionalism and cultural ecology, as well as cultural evolutionary theory. In an earlier paper, Binford (1979:255) discussed "the different modes of procurement, manufacture, use, and discard of tools as these modes are clues to, or correlations with, site functions within a settlement system". For the Nunamiut, both logistical and storage characteristics as well as seasonal variability of their access to different resources are responsible for the variability of technological choices and for the differences of temporo-spatial distribution and forms of artifacts. In different types of settlement-subsistence systems, types of "sites" and technological organization are closely linked. In a highly influential paper published the following year, Binford (1980) argues that the difference between residential movement and logistical movement might be relevant to the number of critical resources and the conditions favoring storage, and proposes that as the length of the growing season decreases, residential mobility would decrease and storage dependence would increase. In Binford's arguments, effective temperature (ET) plays a key role in the settlement subsistence systems and technological organization of hunter-gatherers.

In addition, these two approaches also can be categorized into individual-based and group-based research strategies. The typological studies, especially based on *chaîne opératoire* of specific artifacts, follow Darwinian selectionism as theory. Agency of the flintknappers and their social networking building might play important roles in the evolution of specific lithic technologies. To the contrary, studies of technological organization tend to explain the operating modes of foraging societies, rather than the activity of a specific individual who left the artifacts, in his/her circumstances with conditioned resource background. It is noteworthy that this classification is not totally exclusive binary opposition – the approach of technological organization also refers to provisioning and decision making of individuals on the impending tasks, includes preparation and maintenance of tools and gears, staying or leaving a foraging patch, investing time on searching or processing resources, etc. (Nelson, 1991; Kuhn 1995).

The entangled relationship between the two approaches also can be seen as an extension of the function-style debate in the realm of lithic analysis (more reference, see Meltzer, 1981; Sackett, 1977, 1982, 1985, 1986; Wiessner, 1982, 1983, 1985). Because of the research focus, this monograph will not address this debate. Rather, the point to be addressed here is that frames of reference coming from ethnographic and experimental databases are essential for constructing a robust explanatory framework for the lithic analysis at varying scales. Explanation of three dimensions (time, space, and form) of lithic artifacts calls for the study of lifeways of hunter-gatherers and their cultural dynamics, making possible the reasoning of people-things interaction and the study of mechanism of technological change.

1.2. Toward a Paleosociological Research Strategy

As argued above, variability of lithic artifacts and other aspects of the archaeological record cannot be fully explained if a general referential framework of lifeways of prehistoric hunter-gatherers does not been formed. The difficulties of constructing the framework are as follows. (1) Distribution of the foraging patterns is different from those described by ethnographers. Assuming that human agency is a constant, to effectively use ethnographic data as referential information, the impact of climate change during the Pleistocene-Holocene transition, as well as factors affecting hunter-gatherers during the ethnographic present, should be considered. (2) A methodology of technological studies should be developed to cover subcontinental and/or even global scale. Unfortunately, either the typology approach or the technological organization approach is incapable of developing a methodology to deal with the data distributed in great time depth and vast space and diversified into various types of artifacts and features. Technological variation is always seen as a local phenomenon, making the study of transregional similarity of specific artifact forms tend to adopt explanations of human migration or diffusion. The culture history paradigm perhaps goes toward Darwinian archaeological approach, but for the microblade technology case, it is much more difficult to conduct a project similar to project points (see Chapter 2). The current workable framework of lithic technology in the subcontinental scale is descriptive and/or coarse, therefore it is inadequate to provide insight on the interactions of cultural dynamics and changing landscape resulting from climate change. We need to develop an approach which can effectively combine information of prehistoric foraging societies and paleoclimatic background together to discuss the variation and change of lithic technologies. This is a paleosociological research strategy: studying the interaction between paleoclimate change and social organization of prehistoric foraging societies to learn the working processes of technological and cultural dynamics.

Is there any successful example following a paleosociological research strategy to reconstruct lifeways of prehistoric hunter-gatherers and to study technological change in a (sub-)continental scale as a monograph? Clive Gamble (1986, 1999) made attempts to integrate evidence from stone tools, hunting and campsites and information of social interaction into a series of pictures of social lives of prehistoric occupants in Europe from the Lower to Upper Palaeolithic against dramatic climatic fluctuation in the glacial-interglacial cycles. Social network studies of both primates and modern hunter-gatherers were applied as an analogous database to reconstruct exchange systems of the

occupants. Patterns of raw material movement and possible transportation trajectories are systematically studied to explore expansion of social network from intimate to effective and to extended networks in the past 500,000 years. Gamble (1999: Table 1.3) also put the technological organization into a polarized scheme of hunter-gatherers, variables including social organization, kinship system, interaction pattern, settlement system, reciprocity return system, knowledge base, etc.. Although Gamble does not totally agree with this dualistic classification, it at least suggests that lithic studies should be fully conducted in the context of lifeways of foraging societies and within a holistic framework. The combination of bottom-up and top-down approaches can be used to deal with this kind of research project with an expansive range of time and space. It also inspires the author of this monograph to conduct a similar research project in NE Asia in the near future, after enough supporting data become available.

The current advance of anthropological theories and methods provides opportunities to introduce and apply knowledge of foraging societies to archaeological research questions. In the new version of *The Lifeways of Hunter-Gatherers: The Foraging Spectrum*, Robert Kelly (2013) added a chapter (as Chapter 5 of that book) on technology into his Human Behavioral Ecology (HBE) framework of foraging societies. The differentiation of "soft" technology (the knowledge that foragers need to survive) and "hard" technology (the material things that foragers put between themselves and their environment to achieve a goal) makes it possible to explore the position of technology itself in the whole picture of surviving strategies of the hunter-gatherers, present and past. Kelly also reminds archaeologists that to think about investment in tools and/or elaboration of some technology, factors such as function of the tools, risks conditioning the technological innovation, and mobility of the foraging communities should be considered, since every technology has its cost and benefit and the users need to make decisions according the circumstances in which they are deal with. These factors are aspects of lifeways of prehistoric hunter-gatherers, and the balance of these factors impact structural differences among the materials they left behind, including lithic artifacts (if there are any). Steven Kuhn (2020) emphasizes the significance of "mobility thinking" in the understanding of territories and ranging patterns, social networks, and intra-group variation in mobility, all of which are closely linked with interassemblage variability and cultural ecology of Pleistocene foragers.

Thus, to fully understand variation and change of lithic technology, it is necessary to adopt an anthropology-oriented research strategy and study lithics within their dynamic context. Both time and space are two dimensions of archaeological record to show properties, and paleoclimatic data should be fully considered in terms of the impact of climatic change on resource distribution and abundance. A paleosociological research strategy is designed for these kinds of research projects.

1.3. Microblade-based Industries in the Paleosociological Research

Prehistoric hunter-gatherers, like those of today, should have occupied a space with ecological borders due to their scales of mobility and settlement systems (Binford 1980, 1982a, 1983; Schmader, in press; Yellen, 1977), scale of territoriality if applicable (Cashdan 1983; Dyson-Hudson and Smith 1978; Peterson 1975; Wardle, in press; P.-L. Yu, in press), and scale of social network (Gamble 1999; Gilman 1984; Zeanah, et al., in press) associated with uneven distribution of accessible resources, especially edible plant and animal species. The eco-anthropological boundary dividing different adaptive systems is essential for the study of human decision-making process within the boundary such as residential movement and activity scheduling (Binford 1980; Schmader, in press; Wiessner, 1982), and also to investigate cross-boundary behaviors like large-scale migration linked with trade and exchange, human (re)-colonization, seasonal movement of nomadic peoples, and forced migration and resettlement (Bell-Fialkoff, 2000; Dyson-Hudson and Dyson-Hudson, 1980; Gamble, 2013; Hitchcock, 2012, in press; Satiroglu and Choi, 2015). The latter widely applies to prehistoric and historical hunter-gatherers. Cross-boundary movement at the scale of groups entails the loss of prior patches, local knowledge about resource distribution, and social networks; yet new opportunities arise to organize different lifeways, access new resources, and build new social networks. Thus, cross-boundary behavior is risky, but it is also a buffering strategy adopted in order to avoid risks associated with prior adaptations.

Niche is an effective terminology for investigating how human employ both somatic and extra-somatic means of adaptation to deal with problems resulting from uneven distribution of key resource both spatially and temporally (Binford 2001). Unlike animals, humans build their niches using both biological and cultural means. Cultural innovations such as technology plays an essential role in niche construction, along with controlled use of fire, manufacturing clothes, and building shelters for warmth and protection (Laland, John and Feldman, 2000). However, the application of technology is conditioned by raw material accessibility, activity variability, and basic knowledge of toolmaking for specific functions. For prehistoric hunter-gatherers in NE Asia during the late Pleistocene, lithic technology provided hominins with a new niche from competition with other animals – early tools helped to extract flesh and marrow from mouths of hyenas and other non-human competitors, and ground stone tools gave last hunters and early farmers an advantage in getting nutrients from grains. Microblade technology might have expanded the foraging niche by improving hunting returns and quick (re-)colonization of the Siberia and Beringia (e.g., a niche-filling process). Unfortunately, current knowledge is insufficient for direct investigation of paleo-eco-anthropological boundaries of prehistoric hunter-gatherers. Paleoenvironmental studies can only provide data for local climate reconstruction through

paleoethnobotony, paleozoology, oxygen isotope analysis, and more on riverine, lacustrine, eolian (loess) sediments and others (Li and Sun 2004; Solotchina, et al. 2009; Yang, et al. 2015), while large-scale paleoenvironmental research based on ice core and marine sediments and multi-regional pollen data can at most reconstruct proximate paleo-vegetation distribution globally or regionally during the LGM (Iwase, et al. 2012; Ray and Adams 2001; S.-Y. Wang et al. 2017). On the other hand, anthropological studies on boundaries have mainly focused on assemblage variability across large regions, mostly using types and specific variables of lithic artifacts to outline cultural regions.

In Late Pleistocene NE Asia, techniques of microblade production (see Chapter 2) have been used as an indicator to distinguish material cultures in terms of lithic technology variability, implying that different peoples equipped with specific technological skills were attached to potential ethnic groups. Based on this assumption, many archaeologists devote themselves to the study of origin and spread of microblade technology, try to identify the routes of transmission and expansion, and map them with arrows for chronology and variation of types, following an explanation of cultural change from the framework of migration and diffusion (Gómez Coutouly, 2011; Kuzmin, Keates and Shen, 2007; F. Li, et al. 2019). The culture-historical paradigm based on a typological approach insisted upon by mainstream Paleolithic archaeologists specializing on microblade technology research fails to provide an explanatory framework because it lacks a bridge to link static archaeological remains with dynamic human behaviors (*sensu* Binford 1983). Explanations cannot be developed from simple pattern recognition of archaeological record without considering variability of human activities, resource backgrounds, or consequential materialized archaeological remains. Thus, to provide a strong argument for the old question of origins of microblade technology, we need to change our research strategy to be more anthropology-oriented rather than observed archaeological characteristics and artifacts equated with assumptions about ethnic groups. Two decades ago, Lewis Binford (2001) published *Constructing Frames of Reference* with the help of students and colleagues, seeking a method to study hunter-gatherer lifeways in a global scale through a series of models and projections from known foraging groups with both ethnographic and climate data to extinct or transformed foraging groups and using proximate climate data. Amber Johnson (2014; also see Johnson, et al., in press) refined this methodology and renamed it the macroecological approach. With the help of program EnvCalc2.1, hundreds of variables can be calculated in seconds for localities given basic geographic and climatic data (Binford and Johnson 2014).

This monograph combines the macroecological approach and simulated climate database under the LGM climatic conditions to investigate variability of LGM foraging societies in different regions in NE Asia, as well as behavioral and demographic changes of foraging societies during the glacial-interglacial cycles (MIS3-MIS2-MIS1) (see Part II). The maps, produced with ArcGIS, can help generate anthropology-oriented hypotheses that have potential to be tested with archaeological data. Thus, the macroecological approach, paleoenvironmental database and prehistoric technological organization can be combined to study the role of microblade technology in the development of human adaptations in NE Asia, especially northern China, during the closing millennia of the Upper Pleistocene and across the Pleistocene-Holocene transition. Detailed procedures will be shown in Chapter 4.

Prehistoric hunter-gatherers exploited local resources, including terrestrial plants and animals and aquatic resources, to satisfy their daily needs for survival, organized themselves into different-size groups among dispersed, aggregated, and annually/multi-yearly aggregated phases of subsistence-settlement systems, and maintained or transformed their lifeways in unpacked or packed demographic conditions. A series of maps in this monograph provide robust support for the significant impact of the LGM environment on behaviors of prehistoric foraging societies (see Chapter 5). To effectively investigate cultural change of prehistoric NE Asian hunter-gatherers who were equipped with microblade technology, I propose a new concept, "microblade-based societies" for investigating adaptive strategies from a broader techno-sociological perspective, versus the previous microblade techno-complex, microblade-bearing sites from an archaeological perspective. This represents a new learning strategy for the microblade-based industries.

It is noted that macroecological approach has different versions. Besides the version adopted in this monograph, there is another one which is called ecological niche modeling. Its operating principle is that climatic conditions – especially temperature – changes will drive the distribution and nature of plant biomass. This model can be used to examine the impact that changing temperatures on human's ability to subsist on the specific crops and to reveal the strategies thy used to cope with potential challenges (d'Alpoim Guedes and Bocinsky 2018). Jade d'Alpoim Guedes and her colleagues apply this modelling technique to address how humans adapted their agricultural strategies or invented appropriate technologies to deal with the challenges presented by the myriad of ecological niches in southwest China (d'Alpoim Guedes, 2013, d'Alpoim Guedes and Butler, 2014; d'Alpoim Guedes, Manning and Bocinsky, 2016). This model has not been applied to study microblade assemblages yet, and I will have a specific discussion in Chapter 11 on the topic of the peopling and human adaptation on the Tibetan Plateau. The two modelling methods which can be labeled as macroecological approach are both in the initial stage, waiting archeologists to dig in the "Era of Big Data".

1.4. Organization of the Monograph

The monograph will be divided into four parts (Figure 1.1).

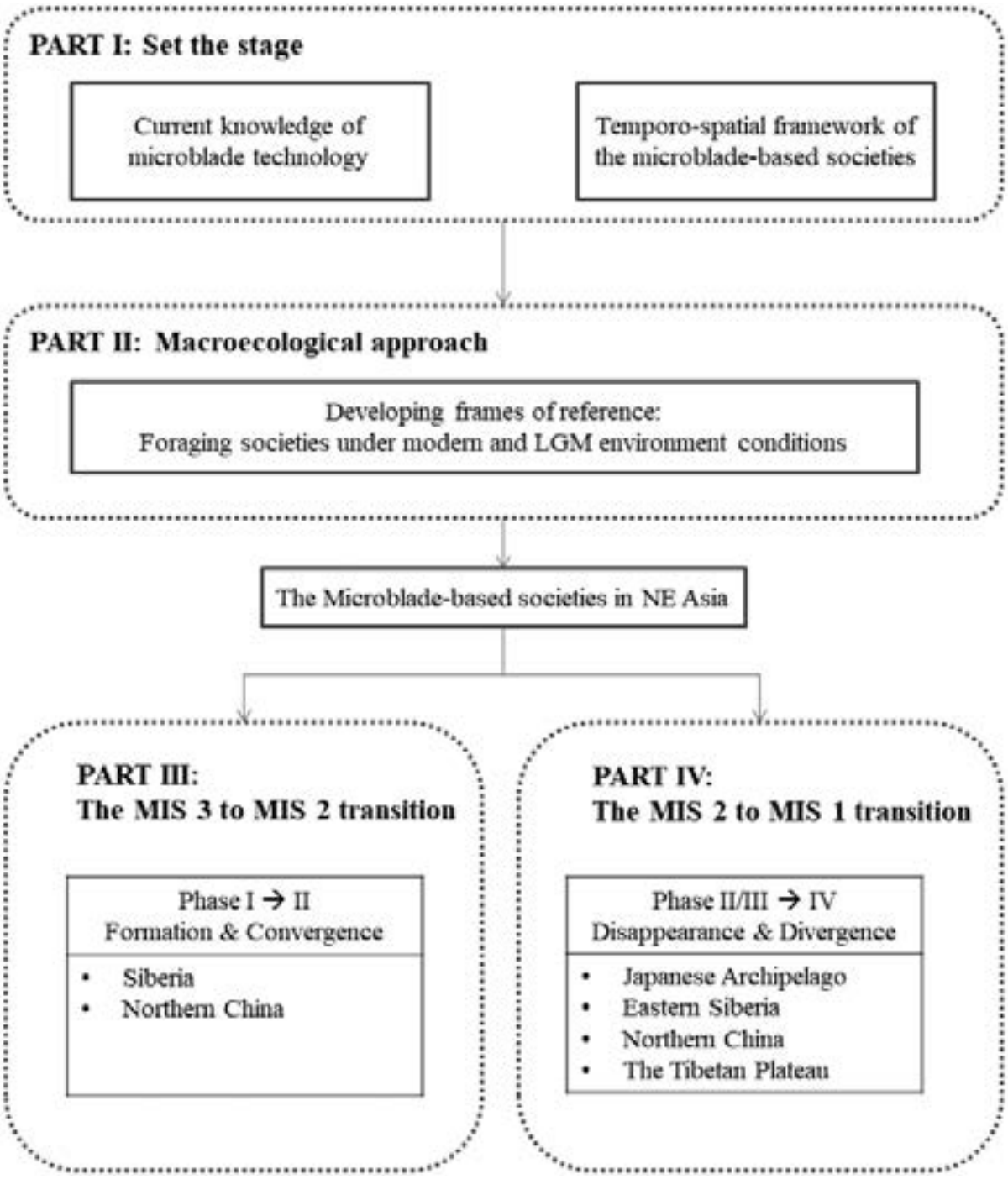

Figure 1.1. Outline of the monograph.

Note: MIS = marine isotope stage; LGM = Last Glacial Maximum.

The first part is to set the stage for the study of microblade technology and microblade-based societies in NE Asia. Here, I will provide a brief introduction on microblade technology and research history of microblade studies across NE Asia, followed by critical evaluation of the influence of the culture-history paradigm on the origin and spread of microblade technology. Then, the geography and paleoclimate of NE Asia will be outlined, especially with respect to climate change during MIS 2, which will provide temporal and spatial dimensions for the archaeological record and development of a macroecological approach. Finally, currently available information will be used to develop a temporo-spatial framework of microblade-based societies.

Part II is about macroecological approach and its potential significance in prehistoric studies. After introducing theories and methods of the macroecological approach, two sets of input database (under LGM and modern climatic conditions) run in the EnvCalc 2.1 program will be produced, followed by two output files linked to behaviors and social organization of hunter-gatherers. Comparison

of the variables using ArcGIS mapping provides macro-scaled pictures of human adaptation to signal the impacts of environmental change (glacial-interglacial cycle from MIS 3 to MIS 2 to MIS 1), through a series of models and ethnographic projections.

The third and fourth parts form the main body of the present monograph and are composed by six case studies done under the aegis of a macroecological approach. This approach is used to develop testable explanations for cultural change among microblade-based societies in NE Asia, based on environmental and ethnographic frames of reference in addition to the patterning observed in empirical archaeological data, during four phases in the late Pleistocene and early Holocene. Part III is on the formation of microblade-based societies, which is linked to the issue of origin and early spread of microblade technology across NE Asia. Then in Part IV, four regions in NE Asia, including the Japanese Archipelago, E. Siberia, N. China, and the Tibetan Plateau, are studied as cases of cultural change during the Pleistocene-Holocene transition.

In summary, the present monograph argues for the appearance of microblade technology as a group of complex emergent and historical processes, rather than purely a series of historical events, which needs be explained in connection with ecological factors, technological innovation, and the foraging behaviors of hunter-gatherers. This monograph is expected to provide an alternative explanation to the mainstream culture-historical approach to microblade technology. With the aid of the macroecological approach, a subcontinental study of microblade-based societies can contribute new ideas on cultural changes among the foraging societies that experienced dramatic environmental change, free archaeologists from the non-explanatory typological approach to lithic assemblages, and usher in a new era in explaining variability and change of foraging societies during the end of the Last Ice Age. Microblade studies are ultimately expected to be more scientific and more anthropological as a result of the approach taken in this book.

If the hunter Keda as well as his ancestors and descendants lived in NE Asia, what would they have done during the Late Pleistocene and Early Holocene? Would tools and weapons equipped with microblades be in their hands? How would they have organized themselves to deal with LGM and post-LGM climate conditions? Let us explore their lifeways at the end of the Ice Age!