**Author**: Oelze, Viktoria Martha
**Title**: Mobility and diet in Neolithic, Bronze Age and Iron Age Germany : evidence from multiple isotope analysis
**Issue Date**: 2012-06-06

# 1. Introduction

## 1.1. Preface

Exactly 30 years have passed since the first application of stable isotope analysis on European archaeological material (Tauber 1981). Since then, much research has focussed on reconstructing palaeodiet, subsistence and mobility in ancient populations across the continent. However, some prehistoric periods and cultures have been addressed more comprehensively than others, and many temporal and spatial gaps in isotope research yet remain (see chapter 4). The scope of this doctoral thesis is to fill these research gaps in prehistoric Germany with a combination of different isotope systems applied to answer a range of different questions. This thesis consists of four main components:

1) The reconstruction of human diet and animal husbandry in the Early Neolithic (chapter 5)

2) The reconstruction of human mobility and provenance in the Early Bronze Age (chapter 6)

3) The reconstruction of human mobility and provenance in the Early Iron Age (chapter 7)

4) Strontium biosphere mapping in south-western Germany as a basis for reconstructing prehistoric mobility (chapter 6 and 7)

The archaeological sites analysed in this work represent populations in highly transitional and innovative phases of cultural and technological evolution. This includes the earliest sedentary agriculturalists in central Europe, the *Linearbandkeramik* (LBK). Dietary behaviour of these first small scale farmers, as well as their strategies in crop cultivation and animal husbandry, are only fragmentarily documented by means of stable isotope research. Unique skeletal preservation at the LBK sites of Derenburg, Halberstadt and Karsdorf in Central Germany allowed biochemical analysis in individuals with determined age and sex. Moreover, the presence of faunal remains enabled the first evaluation of possible herding strategies in this part of Europe during the LBK. The aim of this study is to gain novel information on the influence of age, sex and social status on the human diet. Furthermore, weaning ages and dietary differences or similarities between neighbouring communities are explored. The work presented in this thesis is the first comprehensive palaeodietary reconstruction of LBK populations. This research is part of an on-going project on the lifeways of Neolithic people in Central Germany, conducted by the Institute for Anthropology, Mainz University, Germany.

The study of the human remains from the Early Bronze site of Singen and the Early Iron Age site of Magdalenenberg were part of an interdisciplinary project between the Max Planck Institute for Evolutionary Anthropology (MPI-EVA) and the Department of Pre- and Protohistory at Leipzig University[1]. Both sites can be assigned to the transitional period between small scale farming societies and the rise of major centres of power and influence; both are suggested to have participated in the inception of bronze and iron metallurgy in Germany. Certainly, the development of metallurgy in the Early Bronze and Iron Ages had implications for socioeconomic organization of society and also the transfer networks between distant groups (Wells 2008). Thus, the study of these populations' material cultures and human life history is particularly interesting for archaeology and archaeological sciences.

The rich grave good assemblage recovered from the site of Singen (Hohentwiel) in Baden-Württemberg, near Lake Constance, has become an important reference collection for bronze artefact typology for the north alpine Bronze Age. The copper alloys found at Singen are widely distributed within the European '*Blechkreis*' and extend into the western Alps, the Baltic Sea and the Carpathian Basin (Krause 1988; Krause 2003). However, it has remained poorly understood how these far reaching metal transfer networks were socialized and maintained. It has been proposed that the Singen community may have integrated foreign individuals for this purpose, a hypothesis which has never been tested biochemically. A similar situation applies to the Early Iron Age necropolis of Magdalenenberg, near Villingen in the Black Forest. The monumental burial mount, assigned to the Hallstatt culture, included a central prince grave and numerous inhumations. According to the abundant and partly exotic grave inventories found at the Magdalenenberg tumulus site, the graves were assumed to represent the social elite with a high number of immigrant individuals. Furthermore, it remains unclear whether the majority of the burial community lived locally or if individuals of high status were brought to the Magdalenenberg for an 'appropriate' burial next to the prince (Spindler 2004). The aim of the biochemical analysis presented in this thesis is to reconstruct individual human residence and mobility patterns. By applying different complementary isotope systems, individuals with a non-

[1] under direction of Prof. Sabine Rieckhoff and generously funded by the Federal Ministry for Education and Science, Federal Republic of Germany (BMBF), 2008 to 2012, *Förderkennzeichen* 01UA0811.

local origin can be identified and potential regions of provenance can be assigned. By reconstructing individual life history, initial conclusions on the maintenance of socioeconomic networks in the Bronze and Iron Ages of Germany can be drawn.

While the comprehensive biochemical study on the human and faunal remains was conducted at the MPI-EVA, an archaeologist from the Chair of Prehistory at Leipzig University studied the typology of the artefact assemblages for gender and age related connection to 'foreign' or 'exotic' grave inventories. This on-going work by Julia Koch at the Department of Pre- and Protohistory at Leipzig University will include the scientific evidence presented in this thesis and establish a new theoretical framework for the integration of 'foreign' individuals in prehistoric societies (Koch and Kupke in print). The analysis of stable isotope ratios of carbon and nitrogen for dietary reconstruction was part of a masters thesis at the MPI-EVA by Katharina Kupke (2010) under supervision of Michael Richards. The isotope analysis of sulphur, strontium and oxygen and the synthesis of data were part of this doctoral thesis which started in August 2008. This work included sampling of archaeological material in different museums and institutions as well as the labour intensive wet chemical sample pre-treatment in the sample preparation and ultra-clean laboratories at the MPI-EVA. Moreover, large parts of Baden-Württemberg were visited in a field trip in 2009 in order to collect environmental samples for strontium isotope mapping in the geological landscape which surrounds the sites of Singen and Magdalenenberg. The data from this strontium biosphere mapping were not only necessary for data interpretation in this thesis, but provide a valuable reference for future studies using strontium isotopes in this region.

## 1.2. Isotopic evidence revealed from skeletal remains - a brief science history

In the late 1970's stable isotope analysis was established as a powerful tool for investigating past human diets from their skeletal remains (Vogel and van der Merwe 1977; DeNiro and Epstein 1978; Van Der Merwe and Vogel 1978). The first measures of stable carbon isotope ratios ($\delta^{13}C$) were more or less by-products of radiocarbon dating and were used to check for marine reservoir effects that altered the dating results in fossil tissues. Hence, the first stable isotope studies in Europe derived from radiocarbon laboratories and compared $\delta^{13}C$ values from different archaeological periods. One of the first dietary studies using $\delta^{13}C$ was done on archaeological human remains from Denmark, including a few Iron Age specimens. For the first time, Tauber (1981) demonstrated that the dependence on marine foods had significantly changed through time. A few years later, biochemical research discovered the potential of a combined approach of using $\delta^{13}C$ parallel to nitrogen stable isotopes ($\delta^{15}N$) to classify the dietary background of an organism (DeNiro and Epstein 1981; Schoeninger *et al.* 1983). In European archaeology, this was first applied in 1988 to Iron Age material from Slovenia, resulting in unique evidence for millet consumption in prehistoric Europe. Parallel to this development, a method known from the field of paleoclimatology came into use in archaeology. Longinelli (1984) found that stable oxygen isotope ratios ($\delta^{18}O$) measured in fossil tissue correlated to local meteoric water sources. Thus, drinking water sources of ancient humans could be reconstructed. Simultaneously, the strontium isotope ratio ($^{87}Sr/^{86}Sr$) geochemistry method was first applied to archaeological material to trace human 'residence catchments' and locality (Ericson 1985). The lead isotope ($^{207}Pb/^{206}Pb$, $^{208}Pb/^{206}Pb$) method, previously used to determine the source of archaeological metal ores (Brill 1970), was applied to human skeletal remains to describe human provenance and mobility (Ghazi 1994). However, this approach is still problematic due to the ubiquity of anthropogenic lead in the modern environment, which makes the utility of modern references problematic (Rummel *et al.* 2007). Finally, sulphur stable isotope ($\delta^{34}S$) analysis has recently been introduced and can detect differences between marine, freshwater and terrestrial food sources and in providing information on the geological background of food resources (Richards *et al.* 2001). While the identification of chemical contamination and alteration in fossil tissue (Ambrose 1990; Iacumin *et al.* 1996; Budd *et al.* 2000; Chiaradia *et al.* 2003) and the isotopic characterization of the term 'local' should turn out to be critical for future isotope research in archaeology (Bentley *et al.* 2004; Evans *et al.* 2010), the combination of the various isotope systems has demonstrated the potential to gain direct insights into the life histories of ancient human populations.