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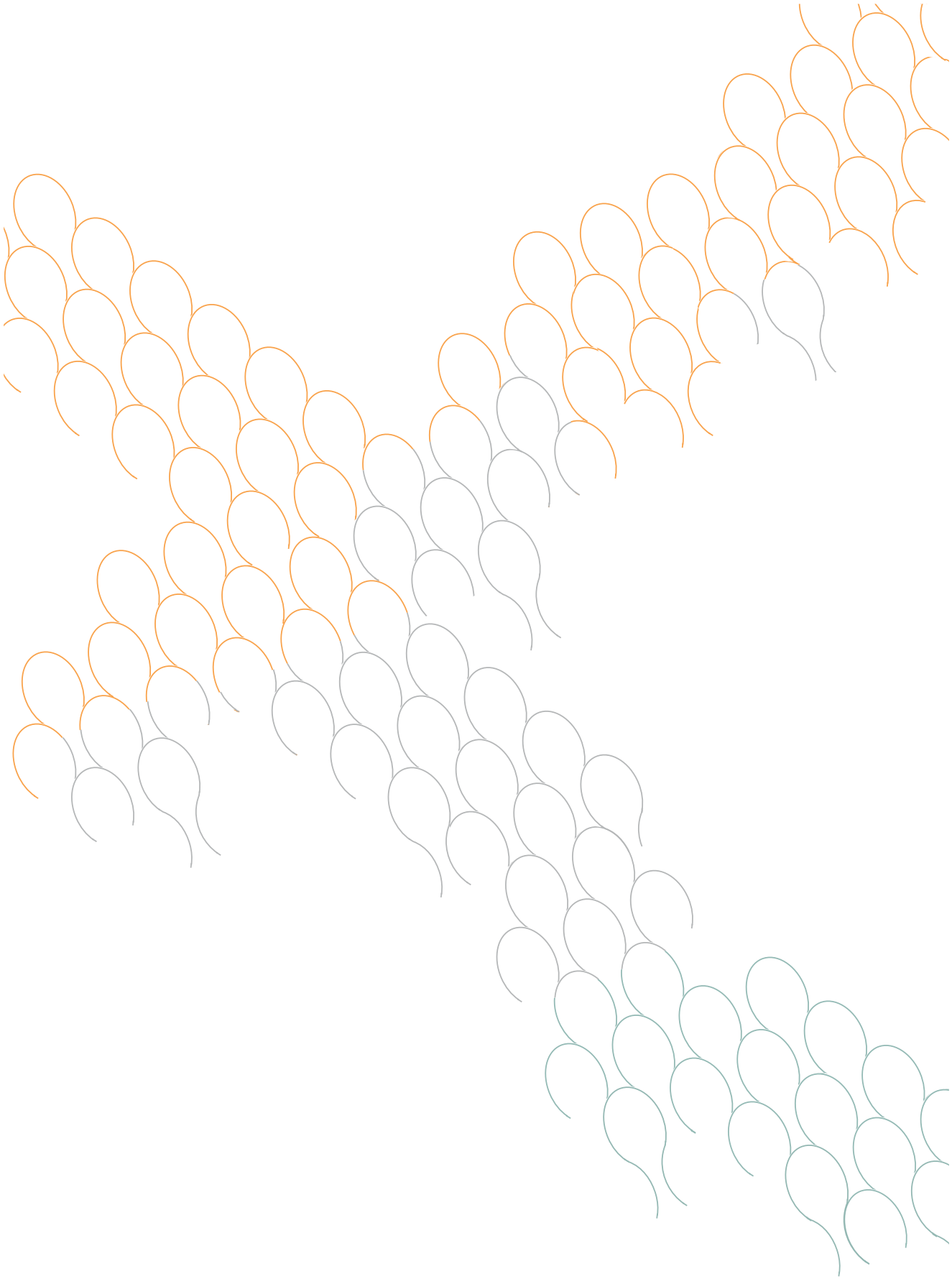

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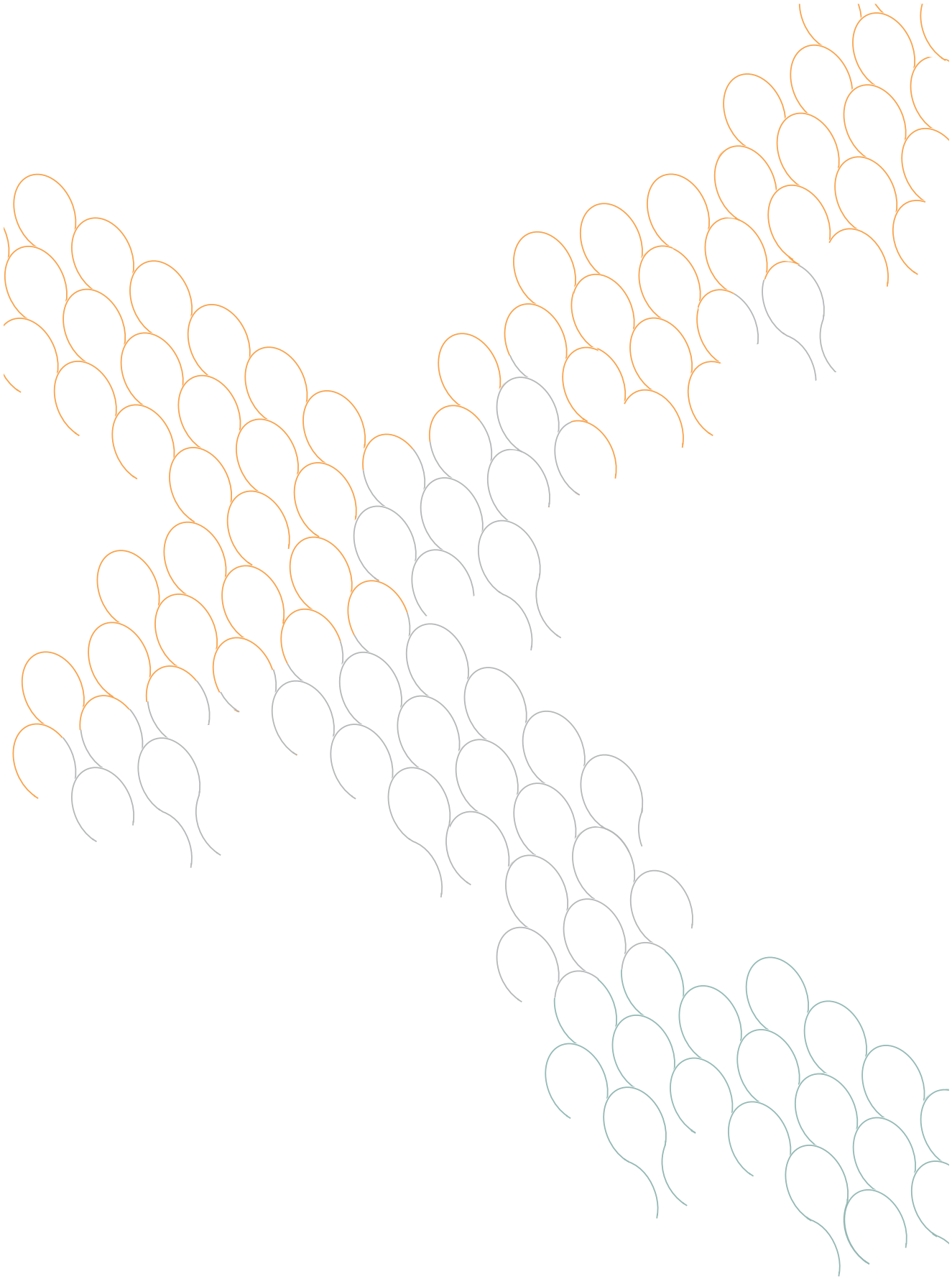

ADDENDA

Summary

Chapters 1 and 2

The first two chapters of this thesis present the aim and purpose of this thesis, as well as detailed background information on the four isotope systems most often used in archaeology: those of strontium, oxygen, carbon and nitrogen. The original models of migratory patterns in (pre)history were based upon the spatial dispersal of cultural artefacts, with the best known proxies for the analysis of migration being the distribution of typological identical artefacts and the merging of typological groups. This approach to trace ancient migration patterns, however, has led to an active debate about the extent to which the archaeological record represents the actual movement of people, or the diffusion of ideas. A new perspective on this debate, and a tool to enable the development of a method to identify migratory patterns and areas of origin, is provided by the archaeological subdiscipline of archaeological science. The isotopes of lead (Pb), neodymium (Nd), oxygen (O), carbon (C), and in particular strontium (Sr) have been extensively used as tracers of origin. The application of these isotopes to solve archaeological questions has matured over the last three decades. Albeit isotope analysis is not a panacea, it is nowadays one of the most widely utilised research fields in archaeological and forensic sciences. Nevertheless, despite its international success and proven potential, a geochemical approach to understanding ancient migratory patterns was, up to a few years ago, only occasionally applied on Dutch cultural heritage. This PhD project therefore aims to fill in this knowledge gap and focuses on the applicability and integration of strontium isotope research in Dutch cultural heritage. As a whole, this PhD thesis follows two research lines, namely: a conceptual line, which concerned the set-up of a dataset with essential baseline $^{87}Sr/^{86}Sr$ data, and an interpretive line, aimed at a broader social-economic and cultural interpretation of the generated data. The main aims of this PhD thesis are to assess the applicability of isotope geochemistry in Dutch archaeology, and to gain more insight into the role mobility might have had in the composition of ancient populations and the possible cultural changes that immigration may have had introduced or catalysed.

Chapter 3

Chapter 3, "Strontium isoscapes in the Netherlands. Spatial variations in $^{87}Sr/^{86}Sr$ as a proxy for palaeomobility", presents the first bioavailable strontium map of the Netherlands. To obtain a full understanding of variations in $^{87}Sr/^{86}Sr$ in archaeological samples, spatial variations in bioavailable strontium should be accurately mapped or inferred. The map presented in this chapter is compiled solely from archaeological enamel samples of rodents and selected mammals as they are considered to provide the best proxy of bioavailable Sr. The diversity of the Dutch geological subsurface is directly reflected in the

spatial distribution of $^{87}Sr/^{86}Sr$ ratios. Six isoscapes are defined: A) Lower terrace of the river Meuse (0.7074-0.7091, n = 2); B) Marine and river Rhine sediments (0.7088-0.7092; n = 85); C) Holland peat area, Kempen and northern sand areas (0.7091-0.7095, n = 14); D) Rur Graben (0.7095-0.7105, n = 11); E) Push moraines (0.7095-0.7110, n = 7) and F) Northern and southern loess areas (0.7104-0.7113, n = 15). Although individual isoscapes may show some overlap, the mean of each isoscape is statistically significant different, except for zones D and E. Five other geological environments yielded no archaeological data, mainly due to poor preservation in acidic soils. To fill this data gap, additional biosphere samples will be collected and analysed. This approach, however, will require validation of the extent to which specific floral are offset compared to the average archaeological bioavailable strontium. The base map presented here now allows such a detailed assessment of potential offsets in the $^{87}Sr/^{86}Sr$ recorded by different proxies at the regional scale.

Chapter 4

Chapter 4 presents the first case study in which the map presented in chapter 3 is applied. This chapter, "Breaking traditions: an isotopic study on the changing funerary practices in the Dutch Iron Age (800 - 12 BC)", presents the oldest human and faunal strontium isotopic data included in this thesis. The practice of cremation was the predominant form of disposal of the dead from the Dutch Late Bronze Age (1100 BC) until the Late Roman Period (AD 270). Urnfields in the Dutch river area, however, were replaced by cemeteries with a mixture of cremation and inhumation graves around the 6th century BC. This study provides the first biogeochemical evidence that these Iron Age communities in the Dutch river area were heterogeneous in terms of geological origins. The high percentage of non-locally born individuals (circa 48%) supports the hypothesis that the change in burial practice was the result of the influx of foreign people, who were being allowed to keep their own burial customs, whereas part of the local inhabitants adapted the burial rites of foreign cultures. These processes lead to a heterogeneous burial rite for some centuries.

Chapter 5

The fifth chapter, "Beyond isolation: understanding past human-population variability in the Dutch town of Oldenzaal through the origin of its inhabitants and its infrastructural connections", presents combined strontium and oxygen isotopic data of a medieval (< AD 1500 and > AD 1500) population from Oldenzaal. It differs from the other chapters, as this manuscript focusses on the processes behind ancient residential mobility and presents a first attempt to interpret the isotopic data from a historic and geographical perspective. Because, although a biomolecular approach potentially provides a detailed reconstruction of the development of ancient populations in terms of palaeodemography and (cultural) origin, it is vital to understand the wider controlling factors in any population change. This chapter presents a first assessment of the mechanisms and

potential controls behind ancient residential mobility through the integration of isotopic data and recently reconstructed early-medieval and early-modern route networks. Strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O$) isotope data are presented from 198 (post)medieval individuals from Oldenzaal, the Netherlands. Based on the detailed reconstruction of historical route networks and network persistence, it is concluded that the town of Oldenzaal was infrastructurally well-connected throughout the Middle Ages and early-modern times (ca. AD 800 – 1600). Despite this conclusion, the isotopic data indicate a population characterized by low variability in terms of origin. Four possible scenarios are proposed that, independently or in combination, may explain the low observed variation in isotopic data, and with that the observed low population dynamism in terms of variety of geological/geographical origins. Besides intrinsic factors such as a biased dataset and interpretative limitations, the historical data clearly shows that broader socio-cultural factors are of crucial importance in the population structure of Oldenzaal. These factors also play an important role in overarching connectivity patterns. In conclusion, the data presented here underline the importance of analysing bioarchaeological data in a multidisciplinary and integrated manner in order to obtain a broad historical and geographical perspective.

Chapter 6

The city of Alkmaar was the first city in the Netherlands that successfully withstood the Spanish army in AD 1573 during the Eighty Years' War (AD 1569-1648). This victory marked a turning point in the revolution and eventually led to the recognition of the Dutch Republic as an independent country. There is a wealth of historical and archaeological data from this important period in Dutch history, but few human skeletal assemblages from the Netherlands can be directly associated with the violence of the Eighty Years'. Two mass graves were encountered during archaeological excavations in the cemetery of the Franciscan Friary in Alkmaar in 2010. The organisation of both graves and the presence of numerous bullets linked the mass graves to a violent event, which in Alkmaar's history must be the siege of Alkmaar in AD 1573. Strontium isotope investigations identified two possible refugees. This chapter, "The Alkmaar mass graves: A multidisciplinary approach to war victims and gunshot trauma" presents the discusses the results of the osteological, isotopic and forensic research on the human remains found in the mass graves and demonstrates ways in which this multidisciplinary approach can contribute to a fuller understanding of the siege of Alkmaar. Moreover, additional carbon and nitrogen isotopic data is presented in the appendix "Subsistence in times of war – a palaeodietary assessment of the victims of the siege of Alkmaar using carbon and nitrogen isotopes". The primary aim of this supplementary study was to assess the palaeodiet of the individuals in both mass graves and to identify possible differences in dietary habits between the suspected male soldiers (S404) and civilian victims (S403). Despite the differences in context between three datasets (i.e., probable civilian victims, soldiers and individuals whose death was not associated with war), differences in palaeodietary pattern are absent.

Chapter 7

The Dutch East India Company (VOC) intended the Cape of Good Hope to be a refreshment stop for ships travelling between the Netherlands and its eastern colonies. The indigenous Khoisan, however, did not constitute an adequate workforce, therefore the VOC imported slaves from East Africa, Madagascar and Asia to expand the workforce. Cape Town became a cosmopolitan settlement with different categories of people, amongst them a non-European underclass that consisted of slaves, exiles, convicts and free-blacks. This chapter, "Dynamics of Indian Ocean slavery revealed through isotopic data from the Colonial era Cobern Street burial site, Cape Town, South Africa (1750-1827)", integrated new strontium isotope data with carbon and nitrogen isotope results from an 18th-19th century burial ground at Cobern Street, Cape Town, to identify non-European forced migrants to the Cape. The aim of the study was to elucidate individual mobility patterns, the age at which the forced migration took place and, if possible, geographical provenance. Using three proxies, $^{87}Sr/^{86}Sr$, $\delta^{13}C_{dentine}$ and the presence of dental modifications, a majority (54.5%) of the individuals were found to be born non-locally. In addition, the $^{87}Sr/^{86}Sr$ data suggested that the non-locally born men came from more diverse geographic origins than the migrant women. Possible provenances were suggested for two individuals. These results contribute to an improved understanding of the dynamics of slave trading in the Indian Ocean world.

Chapter 8

The final chapter of this thesis, "Strontium isotopes in Dutch cultural heritage research: a critical evaluation" contextualises, summarises, and critically evaluates the results of the research carried out in this thesis, assesses the implications of strontium isotope research in Dutch archaeological contexts, and sheds light on potential future directions of research. This study and additional unpublished commercial projects have produced over 1,300 isotope analyses (Sr-O-C-N). The work demonstrates the potential of in particular strontium isotope analysis as a mean to place constraints on the geological origins of both archaeological humans and animals, and to infer information about the cultural or demographic development of a population. Although in most studies specific geological origins could not be defined, the isotope analyses executed to date contributed significantly to our understanding of our (pre)history, as we have now been able to elucidate the population composition in terms of (possible) provenance, and to examine individual dietary behaviour patterns. Theories that were defined more than a decade ago, could now be investigated and confirmed in a quantitative manner. This all contributes to our improved understanding of the socio-cultural dimensions of ancient populations. More importantly, isotope research has now been firmly incorporated in Dutch commercial archaeology. The main conclusion therefore is that the work executed within the framework of this PhD thesis contributed to a more systematic anchorage of the application of biogeochemical methodologies in Dutch commercial archaeology.

Nederlandse samenvatting

Hoofdstukken 1 en 2

De eerste twee hoofdstukken van dit proefschrift presenteren de doelstellingen van dit proefschrift, evenals gedetailleerde achtergrondinformatie over de vier meest gebruikte isotopen in de archeologie, namelijk dat van strontium, zuurstof, koolstof en stikstof. Het onderzoek naar migratie of migratiepatronen werd in het verleden vooral gebaseerd op de ruimtelijke verspreiding van culturele artefacten, waarbij het gebruik van typologieën wellicht het meest bekend is. Deze benadering van het concept "migratie" heeft echter geleid tot een actieve discussie over de mate waarin de ruimtelijke verspreiding van niet-lokale typologieën van archeologische artefacten de daadwerkelijke migratie van mensen representeert, of de diffusie van ideeën. Een nieuwe kijk op dit onderwerp wordt geleverd door de archeologische subdiscipline van de archeologische wetenschap. Met name de isotopen van lood (Pb), neodymium (Nd), zuurstof (O), koolstof (C) en strontium (Sr) worden veel ingezet als tracers van oorsprong, als indicatoren van migratie. Ondanks vele internationale successen en reeds bewezen potentieel werd isotopenonderzoek tot op een aantal jaar geleden slechts sporadisch toegepast op Nederlands cultureel erfgoed. Dit promotieonderzoek heeft zich derhalve gericht op het vullen van deze kennislacune door onder andere de toepasbaarheid van isotopenonderzoek op Nederlands archeologisch materiaal te onderzoeken. Dit proefschrift volgt twee onderzoekslijnen: een conceptuele lijn, die het opzetten van een database met essentiële achtergrond $^{87}Sr/^{86}Sr$ data bevat, en een interpretatieve lijn, gericht op een bredere sociaaleconomische en culturele interpretatie van de gegenereerde isotopendata. Het doel van het onderzoek was het integreren van isotopenonderzoek in de commerciële archeologie, en derhalve bij te dragen aan het (her)schrijven van de Nederlandse geschiedenis.

Hoofdstuk 3

Isotopenonderzoek wordt sedert 30 jaar met veel succes toegepast om archeologische vragen omtrent residentiele mobiliteit te kunnen beantwoorden. Om de verkregen data goed te kunnen interpreteren is het van belang om de ruimtelijke verspreiding van biologische beschikbare $^{87}Sr/^{86}Sr$ waarden in kaart te brengen. Dit hoofdstuk presenteert de eerste archeologische biologisch beschikbare strontiumkaart van Nederland. De kaart is samengesteld op basis van uitsluitend tandglazuur van archeologische knaagdieren en zorgvuldig geselecteerde zoogdieren welke als beste proxy voor het biologisch beschikbare strontium beschouwd worden. De diversiteit van de Nederlandse geologische ondergrond is direct te koppelen aan de ruimtelijke verspreiding van de ratio $^{87}Sr/^{86}Sr$. Op basis van de analyse van 143 monsters zijn zes isoscapes (een portmanteau van de Engelse woorden "isotopes" en "landscapes") gedefinieerd: A) Onderste Maas-terras (0,7074-0,7091, n = 2); B) Zee- en Rijnsedimenten (0,7088-0,7092; n = 85); C) Hollands veengebied, Kempen en

Noordelijke zandgebieden (0,7091-0,7095, n = 14); D) Roergebied (0,7095-,07105, n = 11); E) Stuwwallen (0,7095-0,7110, n = 7) en F), Lössgebied (0,7104-0,7113, n = 15). Hoewel de individuele isoscapes enige overlap laten zien, is het gemiddelde van iedere isoscape statistisch significant verschillend van elkaar, met uitzondering van de combinatie D-A. Er is tot op heden geen data voorhanden uit vijf geologische locaties binnen Nederland. Om deze leegtes te vullen zullen in de toekomst aanvullende monsters uit de natuurlijke omgeving (vegetatie, water, etc.) genomen en geanalyseerd moeten worden. Deze benadering, waarbij gebruik wordt gemaakt van een ander type monster, vereist echter validatie om het verschil tussen de strontiumisotopenratio's tussen de archeologische monsters en de natuurlijke (biosfeer) monsters te kunnen bepalen.

Hoofdstuk 4

In de Late Bronstijd (1100 BC) tot de laat-Romeinse periode (AD 270) werden de overleden leden van een populatie voornamelijk gecremeerd. Maar in 500 BC vindt er met name in het Nederlandse rivierengebied een verschuiving in het begrafenisritueel plaats. Hier werden de doden niet meer gecremeerd, maar begraven. Deze opmerkelijke verandering kan betrekking hebben op de introductie van niet-inheemse, vreemde culturen, dan wel externe contacten binnen de inheemse populatie, door bijvoorbeeld uitwisselingsnetwerken en allianties. De nieuwe culturen die de mogelijke immigranten met zich meebrachten zouden geïntegreerd kunnen zijn binnen de lokale cultuur, met als gevolg dat het begrafenisritueel veranderde. In dit hoofdstuk worden de resultaten van het strontiumisotopenonderzoek gepresenteerd dat is uitgevoerd op een groot aantal inhumatieresten uit het Nederlandse rivierengebied. Deze studie levert het eerste bioarcheologische bewijs dat lange afstand migratie van zowel mens als dier naar Nederland plaats vond tijdens de IJzertijd. Het relatief hoge percentage niet-lokaal geboren of opgegroeide personen (tot circa 48%) in vergelijking met andere IJzertijd vindplaatsen in Europa ondersteunt de hypothese dat de verandering in het begrafenisritueel veroorzaakt is door de toenemende heterogeniteit van de bevolking op het gebied van (culturele) komaf. De aanwezigheid van mensen met een andere culturele achtergrond en/of geografische herkomst kan geleid hebben tot de aanvaarding en/of implementatie van nieuwe begrafenisrituelen in het Nederlandse rivierengebied. Dit hoofdstuk laat zien dat door de toepassing van isotopenonderzoek ook informatie verkregen kan worden over de culturele veranderingen die binnen populaties plaatsvonden.

Hoofdstuk 5

Hoewel bioarcheologisch onderzoek het potentieel heeft om een gedetailleerde reconstructie van de ontwikkeling van een (pre)historische populatie te maken in termen van demografie en (culturele) komaf, is het van essentieel belang om de bepalende factoren te begrijpen die de veranderingen in binnen een populatie faciliteren of juist

tegenhouden. In dit hoofdstuk worden de resultaten gepresenteerd van een eerste poging om de mechanismen en bepalende factoren te achterhalen die een groot effect hebben gehad op de geobserveerde mate van mobiliteit in Oldenzaal. Hiertoe is voor het eerst strontium- ($^{87}Sr/^{86}Sr$) en zuurstofisotopendata ($\delta^{18}O$) van 198 individuen uit (post) middeleeuws Oldenzaal en recent opgebouwde vroegmiddeleeuwse en vroegmoderne routenetwerken geïntegreerd. Op basis van een gedetailleerde reconstructie van de historische routenetwerken en netwerk-persistenties kan geconcludeerd worden dat Oldenzaal infrastructureel goed ontsloten was gedurende de Middeleeuwen en de vroegmoderne tijd (ca. AD 800-1600). Desondanks wijzen de resultaten van het isotopenonderzoek op een populatie dat gekenmerkt werd door een lage variabiliteit in termen van herkomst. Een hoge mate van connectiviteit van een stad kan derhalve niet gekoppeld worden aan een hoge mate van mobiliteit binnen een populatie. Vier verschillende scenario's zijn gedefinieerd die, onafhankelijk of in combinatie met elkaar, de waargenomen lage variatie in isotopendata zouden kunnen verklaren. Naast intrinsieke factoren, zoals een dataset die aan een bias onderhevig is, of de interpretatieve beperkingen, kunnen bredere sociaal-culturele factoren, zoals de toegankelijkheid van een stad voor de influx van immigranten, van cruciaal belang zijn bij de opbouw bij de opbouw van een populatie. De in dit hoofdstuk gepubliceerde gegevens onderstrepen het belang van een multidisciplinaire en geïntegreerde benadering van de analyse van bioarcheologische (fysisch antropologische, isotopen- en DNA-) data om de ontwikkeling van een (pre)historische bevolking zo accuraat mogelijk, en vanuit een breed historisch en geografisch perspectief, te kunnen begrijpen.

Hoofdstuk 6

De stad Alkmaar was de eerste stad in Nederland die in 1573 met succes tegen het Spaanse leger streed tijdens de Tachtigjarige Oorlog (1569-1648). Deze overwinning betekende een keerpunt in de revolutie en leidde uiteindelijk tot de erkenning van de Nederlandse Republiek als een onafhankelijk land. Er is een schat aan historische en archeologische gegevens uit deze belangrijke periode in de Nederlandse geschiedenis, maar slechts weinig menselijke skeletresten kunnen direct gekoppeld worden aan het geweld van de Tachtigjarige oorlog. Tijdens de archeologische opgravingen op de Paardenmarkt in Alkmaar in 2010 werden twee massagraven aangetroffen: een groot massagraf met daarin de skeletresten van enkel mannelijke individuen, en een klein massagraf waarin de resten van mannen, vrouwen en kinderen aangetroffen werden. De wijze waarop de graven gevuld zijn, alsmede de aanwezigheid van een groot aantal kogels in het grote massagraf doet vermoeden dat de massagraven gekoppeld kunnen worden met een gewelddadige gebeurtenis. In de geschiedenis van Alkmaar moet dit het beleg van de stad in 1573 zijn. In dit hoofdstuk worden de resultaten van het fysisch antropologische onderzoek en het isotopenonderzoek naar de menselijke resten, en het forensische onderzoek naar de kogels gepresenteerd. Uit het isotopenonderzoek blijkt dat in de mannen uit het grote massagraf allemaal mogelijk van lokale komaf zijn. In het kleine massagraf liggen

mogelijk de resten van twee 'vluchtelingen' begraven, waaronder dat van een kind dat pas vlak voor zijn dood in (de regio rondom) Alkmaar is komen wonen. Tevens laat dit hoofdstuk zien dat een multidisciplinaire aanpak kan bijdragen aan een beter begrip van gewelddadige gebeurtenissen die onze geschiedenis kent.

Hoofdstuk 7

De Nederlandse Oost-Indische Compagnie (VOC) vestigde zich bij Kaap de Goede Hoop op de locatie van het huidige Kaapstad een haven waar de schepen aan konden meer om de voorraad proviand weer aan te vullen. De inheemse bevolkingsgroep, de Khoisan, waren echter niet bereid hard voor de Nederlanders te werken. Daarom begon de VOC met het importeren van slaven uit het oosten van Afrika, Madagaskar en Azië om het personeelsbestand met adequate werklieden uit te breiden. Kaapstad werd een kosmopolitische nederzetting met verschillende groepen mensen, waaronder een niet-Europese onderklasse die bestond uit slaven, bannelingen, veroordeelden en de "vrije zwarten". In dit hoofdstuk wordt nieuwe strontiumisotopendata gepresenteerd in combinatie met reeds bestaande koolstof- en stikstofisotopendata van een 18e-19e eeuwse begraafplaats, gelegen aan de hedendaagse Cobern Street in Kaapstad, Zuid-Afrika. Het doel van het onderzoek was niet-Europese geforceerde/gedwongen migranten te identificeren die voor de VOC naar de Kaap waren gebracht. Door de combinatie van verschillende isotopen en de analyse van meerdere gebitselementen per individu zijn we in staat geweest om de individuele migratie patronen, de leeftijd waarop de gedwongen migratie heeft plaatsgevonden en, zo mogelijk, de geografische herkomst van de individuen te onderzoeken. Door het gebruik van drie proxies, $^{87}Sr/^{86}Sr$, $\delta^{13}C_{dentine}$ en de aanwezigheid van tandheelkundige modificaties, zoals het slijpen van de voortanden, kan geconcludeerd worden dat de meerderheid van de onderzochte individuen (54,5%) niet van lokale komaf zijn. Bovendien suggereren de $^{87}Sr/^{86}Sr$ data dat de niet lokaal geboren mannen uit meer verschillende gebieden afkomstig zijn dan de vrouwen. Voor twee individuen kon zelfs op basis van de strontiumisotopendata een mogelijke herkomst vastgesteld worden. De resultaten van dit onderzoek dragen bij aan een beter begrip van de dynamiek van de slavenhandel in de Indische Oceaan.

Hoofdstuk 8

Het laatste hoofdstuk van dit proefschrift, "Strontiumisotopen in het Nederlands cultureel erfgoedonderzoek: een kritische evaluatie" contextualiseert en evalueert de resultaten van het onderzoek die in het kader van dit promotieonderzoek zijn verkregen. In totaal zijn de afgelopen jaren meer dan 1.300 isotopenanalyses (Sr-O-C-N) uitgevoerd. De resultaten van het onderzoek tonen aan dat vooral strontiumisotopenonderzoek een belangrijke rol kan spelen in het onderzoek naar de geologische komaf van mens en dier, en informatie kan verschaffen over de culturele en demografische ontwikkelingen die

populaties door de jaren heen meemaken. Isotopenonderzoek kan derhalve een zeer belangrijke bijdrage leveren aan het (her)schrijven van onze geschiedenis. Theorieën die meer dan tien jaar geleden werden gedefinieerd, kunnen nu onderzocht en geverifieerd of gefalsifieerd worden op een meer kwantitatieve wijze. Dit alles draagt zonder twijfel bij aan een verbeterd begrip op de sociaaleconomische dimensies van oude populaties. Het belangrijkste doel dat bereikt is met het uitgevoerde promotieonderzoek is dat isotopenonderzoek nu stevig ingebed is in de Nederlandse commerciële archeologie. Derhalve heeft het uitgevoerde isotopenonderzoek bijgedragen aan een meer systematische verankering van biogeochemische methodieken in de Nederlandse commerciële archeologie.

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Data dissemination

During the period 2009-2017, archaeological isotope data were generated through the execution of a large number of (commercial) projects. A selection is included in this thesis and published in, or submitted to peer-reviewed academic journals and books. The vast majority of the output, however, is published in archaeological site reports and available via online data repositories (such as DANS Easy - easy.dans.knaw.nl).

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A

Dankwoord

My journey in isotope archaeology started in 2010 when dr. Oliver Craig, today professor and managing director of BioArCh at the University of York, stepped in my office at the former Institute for Geo and Bioarchaeology at the Vrije Universiteit. He sat down, and asked one of the most important questions: “What do you want to do?”. Soon after that, funds were made available to undertake training in preparing dental enamel samples, clean lab protocols, strontium isotope extraction methodologies, and in the use of the thermal ionisation mass spectrometer (TIMS). Through his efforts, I was able to gain vital knowledge about everything one needs about isotope archaeology. Thank you, Oliver, for helping me to pursuit a career in isotope archaeology!

However, none of this would have been possible if prof. dr. Henk Kars had not decided to welcome me back at the Institute in 2008, after I finished my PGDip in Osteoarchaeology at Bournemouth University, United Kingdom. He gave me the freedom to further develop myself within the field of bioarchaeology, and encouraged me to explore this line of research. Henk, I highly appreciate your guidance and support throughout my time as a BSc/MSc/PhD student, dank u wel!

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Almost exactly 7 years after Oliver funded my training in isotope archaeology, Gareth asked me the very same question. What I wanted to do next. The answer is simple: to continue what we have started, and to further explore the application of various isotope systems in archaeology. I would love to upgrade the strontium isoscape map myself, initiate new and intensify the present collaborations between academic departments and universities, and pursuit a beautiful career in isotope archaeology in the Netherlands. To date, and with everlasting and passionate enthusiasm, I have processed over 1,300 isotope analyses, and participated in more than 20 national, and international projects. Archaeological research questions finally found their answers through the produced isotope data, but, more importantly, more fundamental research questions of relevance were generated. I loved having the opportunity to engage in archaeological projects, to

contribute to our cultural history, and I found the conversion of generated isotope data to scientific manuscripts one of the most rewarding exercises of all. All of the above would not have been possible without the help and friendship of the many dedicated people I was fortunate enough to collaborate with and learn from.

One of the main goals of this project was to achieve a stable and systematic anchorage of the application of biogeochemical methodologies in Dutch commercial archaeology. The fact that the first steps are taken towards a systematic application of isotopes in bioarchaeological research is also due to the everlasting enthusiasm and help of my dear friend, colleague, and paranymph Eveline Altena (Forensic Laboratory for DNA Research), for which I want to express my sincere gratitude. More than six years ago, in March 2011, "Skeletloket" was born in a pub in Amsterdam. Skeletloket represents the collaboration between the two of us, and aimed at the full integration of physical anthropological, stable isotope and DNA data in archaeological research and reports. We set ourselves the goal to successfully merge academics and commercial parties in archaeological projects; a challenging, but rewarding task. Eveline, you are the best ambassador of isotope archaeology and aDNA research one could imagine. And a true friend. Thank you so much!

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Curriculum vitae

Lisette Marjolein Kootker was born on the 4th of November 1981 in Alkmaar, the Netherlands. After obtaining her high school diploma in 2001, she started to study Geoarchaeology at the Vrije Universiteit Amsterdam. In 2007 she obtained her master's degree in Earth Sciences, specialisation Archaeometry *cum laude*. In September 2007, she commenced further study at Bournemouth University, United Kingdom, obtaining a PostDip. in Osteoarchaeology with distinction in 2008. From 2008 to 2014, Lisette worked as a researcher at the Institute for Geo- and Bioarchaeology (IGBA), Vrije Universiteit Amsterdam. In 2012, prof. dr. Gareth Davies initiated this PhD thesis in collaboration with prof. dr. Henk Kars. After the IGBA was discontinued in 2014, she joined the Geology and Geochemistry Cluster until July 2017. She is also employed by Archeoplan Eco in Delft as a KNA specialist Archaeozoology since 2008. Lisette is currently affiliated to Leiden University, Faculty of Archaeology, as a visiting researcher until March 2018, and will be appointed as a post-doctoral research fellow at the Vrije Universiteit Amsterdam from the 1st of January 2018 onwards.

Lisette is a board member of the Dutch Association for Physical Anthropology since 2012, and co-initiated "Skeletloket" in 2011; a collaboration with the Dutch aDNA lab with the goal of increasing the quantity and quality of bioarchaeological research in Dutch commercial archaeology and the integration of isotope and aDNA data in archaeological reports. She lives in Heiloo together with Dennis Mes and their two children, Danique (2014) and Quinten (2017).

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