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The adoption of pottery into the New World

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Summary in English

This PhD research investigates the adoption of pottery technology into New World Subarctic (i.e., Southwest Alaska), through the application of organic residue analysis and stable isotope analysis to identify pottery function. While durable containers such as pottery first made their appearance as early as 20,000 years ago in southeastern China, the adoption of such technologies was significantly delayed in (sub)Arctic regions. In fact, the very presence of pottery in this extreme marginal area has long been considered an enigma, as the Arctic environment and climate is ill-suited for pyrotechnology. Nonetheless, ceramic technology made an abrupt appearance in Alaska by about 2,800 years ago. While there is general consensus that the ultimate source of this Alaskan pottery tradition lay in Northeast Asia, the drivers behind the adoption of pottery into the New World have remained largely unclear, but are thought to be associated with a maritime intensification.

By applying organic residue analysis to nearly 40 early pottery vessels from the Alaska Peninsula it was found that early pottery was in fact generally used to process anadromous species such as salmon. This riverine focus of pottery function is further supported by the distribution of early pottery sites adjacent to large river systems, both in Alaska as well as in Northeast Siberia. It is only later that a focus on the coastal zones becomes apparent. Therefore, while some have suggested (or assumed) that Alaskan pottery was a tool inherent to maritime adaptations, mainly on the basis of ethnographic information, we argue that the first Alaskan (Norton) pottery was in fact an integral part of a riverine adaptation that originated in the Late Neolithic cultures of interior Northeast Siberia.

The shift from a riverine to a marine focused function of the pottery occurs in Alaska with the introduction of the Thule phase (ca. 1,000 cal BP to contact times). This is apparent on the

Alaska Peninsula and on Kodiak Island where about 40 Thule and Koniag vessels were tested. Locally, differences in uptake are apparent. In the Aleutian Islands stone bowls, used to render marine mammal oils, occur as early as 9,000 years ago, but were never used on the neighbouring Alaska Peninsula. On Kodiak Island pottery adoption was significantly delayed (by 2,000 years compared to the Alaska Peninsula). These differences in uptake may reflect long-established social boundaries that are apparent in material culture as well as in linguistics on Kodiak Island, the Alaska Peninsula and the Aleutian Islands. Nonetheless, this research shows a fairly uniform function for durable container technologies in SW Alaska: the processing of aquatic resources. These insights make an original contribution to the wider debate on hunter-gatherer pottery adoption, and further supports its connection to the exploitation of aquatic products.

Samenvatting in het Nederlands

In dit doctoraal onderzoek staat de adoptie en functie van aardewerk technologie in Subarctisch (zuidwest) Alaska centraal. Dit is onderzocht door middel van vetzuuranalyse en isotopenanalyse. In zuidoost China was aardewerk al zo'n 20,000 jaar geleden in gebruik. In het Arctisch en Subarctisch gebied was de adoptie van deze technologie echter significant vertraagd. Vanwege het koude, en vochtige klimaat, alsmede het gebrek aan bomen voor brandhout, is het voorkomen van aardewerk technologie in het hoge noorden zelfs lange tijd gezien als zeer uitzonderlijk en afwijkend. Desondanks werd aardewerk toch zo'n 2,800 jaar geleden plotseling geïntroduceerd in Alaska. De algemeen geaccepteerde origine van deze technologie ligt in Noordoost Azië. Echter, de factoren die de verspreiding van aardewerk aandreven zijn nog grotendeels onbegrepen, en zijn tot nu toe vaak toegeschreven aan een intensivering van een maritieme adaptatie.

Door de methode *vetzuuranalyse* toe te passen op 40 aardewerken potten afkomstig van de Alaska Peninsula, is het duidelijk geworden dat dit vroege aardewerk in werkelijkheid voornamelijk gebruikt werd voor het verwerken van anadrome vissoorten, zoals zalm. Deze focus op het vissen in rivieren wordt verder onderbouwd door de verspreiding van archeologische vindplaatsen met aardewerk in Alaska, allen gelegen in de zeer dichte nabijheid van grote riviersystemen. Dit is een patroon wat ook in noordoost Siberië zichtbaar is. Alhoewel ook de vroege vindplaatsen in Alaska dicht bij de kust blijven, zijn deze altijd te vinden nabij riviermondingen. Pas later (ca. 1,000 jaar geleden) neemt de jacht op mariene zoogdieren toe. In dit onderzoek is voorgesteld dat het vroegste aardewerk in Alaska niet verbonden was met een maritieme adaptatie, maar in werkelijkheid een integraal onderdeel was van een intensieve focus op het grootschalig vissen naar zalm in de rijke rivieren van zuidwest Alaska: een traditie die zijn oorsprong vindt in noordoost Siberië.

Met de introductie van de maritiem gefocuste Thule cultuur in Alaska, zo'n 1,000 jaar geleden, veranderde de functie van het aardewerk. Op de Alaska Peninsula, alsmede op Kodiak Island, is dat goed zichtbaar in de organische residuen van aardewerk uit deze latere fases (ca. 40 monsters). Die zijn voornamelijk marien van oorsprong. Ondanks de aanwezigheid van deze grote trends zijn er toch ook grote verschillen in de lokale adoptie van aardewerk zichtbaar. In de Aleoeten werden al 9,000 jaar lang stenen kommen gebruikt voor het verwerken van marine vetten en olie van zeezoogdieren. Echter, deze artefacten zijn nooit gevonden op de nabijgelegen Alaska Peninsula. Bovendien, op Kodiak Island werd aardewerk lange tijd geweerd, en vond de adoptie van de technologie pas 2,000 jaar later dan op de Alaska Peninsula plaats. Deze verschillen in de adoptie van aardewerk, en de weerstand daartegen, komt hoogstwaarschijnlijk voort uit diep gevestigde sociale verschillen en grenzen tussen verschillende culturele groepen. Dit soort sociale grenzen zijn duidelijk waarneembaar

in archeologische context aan de hand van artefact vorm en stijl, maar ook aan bijvoorbeeld verschillen in dialect tussen de regio's, en zelfs intraregionaal op Kodiak Island tussen het noorden en zuiden. Desalniettemin, aan de hand van de resultaten van dit onderzoek, is gebleken dat de functie van aardewerk en stenen potten, ondanks subtiele verschillen, zeer uniform was: namelijk voor het verwerken van aquatische dieren.

Dit onderzoek draagt bij aan het grotere debat over de adoptie van aardewerk door jager-verzamelaarsgroepen, en de onderzoeksresultaten ondersteunen de connectie tussen jager-verzamelaarsaardewerk en de exploitatie van aquatische producten.

ACKNOWLEDGEMENTS

This PhD dissertation was powered by curiosity, perseverance, and will power. But just as much by good music, nature, friends, campfires and alcohol. The past four years have been a rollercoaster of knowledge acquisition and transformative experiences. I mastered the bioarchaeological method of organic residue analysis from scratch. I learned a great deal about lipids, isotopes, archaeology, and academia. But also about myself and the things that matter to me. In collecting my samples I travelled extensively through Alaska and the “*Lower 48*”. I camped on deck of the Tustumena – Alaska Marine Highway Ferry, I kayaked with humpback whales, and I observed Kodiak’s famous salmon runs first hand. But mainly, it was the people that I met along the way that made this the experience of a lifetime.

Foremost, I thank my supervisors, Peter Jordan and Oliver Craig, for their guidance and enthusiasm, for believing in me, and for giving me the space to bring this project home in my own way. Furthermore, I thank the examining committee: Ben Fitzhugh, Carl Heron, and Hans van der Plicht, for the interest taken in my work and the thorough examination of my manuscript. I am thankful to the Faculty of Arts of the University of Groningen for funding my PhD research, and to the Arts and Humanities Research Council for their contribution to the analytical costs. My training at the University of York – BioArCh laboratory played a crucial part in completing this work. I am in great debt to Shinya Shoda and Alexandre Lucquin for teaching me the method with such patience and care. My “*Biomolecular Archaeology*” notebook, where I obsessively wrote down all that you taught me, is still one of my most prized possessions.

The materials studied in this project are the indigenous cultural heritage of Alaska. I am sincerely grateful for the trust put in me by the various native corporations to study these materials. Many thanks to: the Ounalashka Corporation, the Old Harbor Native Corporation, Koniag Inc., and Akhiok Kaguyak, Inc. I would also like to thank the U.S. Fish and Wildlife Service, the Oregon Museum of Natural and Cultural History, the Katmai National Park Service, the Anchorage Museum – Arctic Studies Centre, the Museum of the Aleutians, and the Alutiiq Museum for granting me access to the artefacts. And thank you to Marnie Leist, Pamela Endzweig, Kathryn Myers, and Aron Crowell for helping me navigate the collections.

Of those people I met along the way, I want to make special mention of Don Dumond, who showed limitless enthusiasm for my project from the very beginning. Who helped me select the pottery analysed here, and who insisted on climbing storage ladders to collect those materials at the age of 87. I feel very fortunate to have been able to work with such a knowledgeable researcher and exceptional human being. Many others contributed to this work in various ways. I am thankful to Patrick Saltonstall for welcoming me to Kodiak Island, sharing ideas and providing comments to the Kodiak chapter, together with Amy Steffian. Thank you to Virginia Hatfield for inviting me to publish my Aleutian results in the special issue of *Quaternary Research*. I further owe my thanks to Rick Knecht, Tom Farrell, Frits Steenhuisen, Lea Drieu, Simone Casale, and Loe Jacobs for their contributions to the research.

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Thank you to my colleagues, friends and family for their support. Thank you to Nicole and Zach for letting me stay on their couches during my research travels, and for taking me on all those adventures. And special thanks to my mom, to my sister Roos, and to my friends Detty, Lotte, Constance, Jamie, Liz, Bo, Harm Jan, and Elise for having been there for me. To those I forgot to mention: I am sorry, my mind is filled up with pottery sherds, I may never recover.

*“We shall not cease from exploration, and the end of all our exploring
will be to arrive where we started and know the place for the first time.”*

– T.S. Elliott –

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Profile: I am a New World Arctic archaeologist trained in biomolecular and chemical methods such as lipid residue analysis and (compound specific) isotope analysis. Currently I am in the final stages of my PhD research on early Alaskan pottery at the University of Groningen in collaboration with the BioArCh lab of the University of York, where I completed my lab training. My research interests include Alaskan prehistory, bioarchaeological methods, the peopling of the Americas, the adoption of pottery by hunter-gatherers, hunter-gatherer subsistence practices, and many more.

EDUCATION:

2016-2017 Laboratory training: *organic residue analysis*,
BioArCh lab, University of York (1 year).

2010 - 2013 Research Master *Art History and Archaeology*,
University of Groningen (August 31, 2013)

2007 - 2010 Bachelor *Archaeology*,
University of Groningen (August 31, 2010)

2004 - 2007 *Communication*,
Hanze University of Applied Sciences, Groningen
(Propaedeutic achieved)

CURRENT EMPLOYMENT:

2015 - 2019: PhD researcher, Arctic Centre - Groningen Institute of Archaeology,
University of Groningen. Project title: *Prehistoric food technologies, maritime adaptations
and climate change in the North Pacific*. Supervisors: prof. Peter Jordan (University of
Groningen) and prof. Oliver Craig (University of York).

EMPLOYMENT HISTORY:

- 2014 Secretary, Department of History and International Relations, University of Groningen
- 2012 (6 months) Student Assistant, Groningen Institute of Archaeology, University of Groningen
- 2011 (6 months) Secretary of Research, Groningen Institute of Archaeology, University of Groningen
- 2003 – 2011 Homecare (cleaning), Thuiszorg Groningen.

GRANTS:

- 2018: Dr. Catharine van Tussenbroek fonds (*conference visits*: €1250,-)
- 2018: Dutch Ministry of Foreign Affairs (*Emerging Leaders program*) (€3000); Willem Barentz Stichting (€360,-)
- 2017: ARCHON (*conference subsidy*) (€400,-)
- 2012: Marco Polo grant (*internship USA*: €500,-)
- 2011: Erasmus grant (*MA course on Spitsbergen*: €600,-)

PRIZES AND AWARDS:

- 2013: Winner of the Groningen Institute of Archaeology MA thesis prize (1st place).
- 2013: Winner of the NRG Battle 'Arctic Energy Development' with the article: *An Arctic marriage of innovation, science and industry.*

CONFERENCE PRESENTATIONS AND INVITED LECTURES:

- 2018 *Leftovers. The preservation of manufacture derived lipids in pottery during the firing process.* September 20. Poster presentation at the 8th International Symposium on Biomolecular Archaeology, Jena, Germany.
- 2018 *The enigma of Alaskan pottery.* September 6. Presentation at the European Association for Archaeologists Annual Meeting, Barcelona, Spain.
- 2018 *What's cooking? Investigating the function of prehistoric stone bowls and griddle stones in the Aleutian Islands by lipid residue analysis.* April 12. Poster presentation at the Society of American Archaeology 83rd annual meeting, Washington DC, USA.
- 2017 *Alaska's earliest container technologies: An organic residue study into the function of pottery and stone vessels from SW Alaska.* March 30. Presentation at the Society of American Archaeology 82nd annual meeting, Vancouver, Canada.

- 2016 *Prehistoric Food Technologies, Maritime Adaptations and Climate Change in the North Pacific*. August 4. Public Lecture at the Alutiiq Museum, Kodiak, USA.
- 2015 *Prehistoric Food Technologies, Maritime Adaptations and Climate Change in the North Pacific*. August 7. Public Lecture at the Museum of the Aleutians, Unalaska, USA.
- 2013 *The Origin and Evolution of the Mesa Projectile Point*. May 28. Farewell Symposium prof.dr. Louwrens Hacquebord, Groningen.
- 2010 *The Release of Greenhouse Gases due to Permafrost Thaw*. February 8. IMAKA Study Society: Kantelpunten, Permafrost en Broedsucces, Groningen.

TEACHING:

- 2015 *The Peopling of the Americas*. November 24. Lecture for the BA-level minor Arctic Studies at the University of Groningen.
- 2015 *The archaeology of northern North America*. April 2. Introduction lecture for prospective BA-students at the University of Groningen.

PUBLICATIONS:

Admiraal, M., Lucquin, A., Casala, S., Jordan, P., and Craig, O. (accepted, June 12, 2019) Leftovers: the presence of manufacture-derived aquatic lipids in Alaskan Pottery. Submitted to *Archaeometry*.

Admiraal, M. & Knecht, R. (2019) "Understanding the Function of Container Technologies in Prehistoric Southwest Alaska" in: *Ceramics in Circumpolar Prehistory: Technology, Lifeways and Cuisine*, edited by P.D. Jordan and K. Gibbs. Cambridge University Press.

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Peeters, J., Admiraal, M. & Verneau, S. 2015 *Afslag Olthof: Archeologisch onderzoek naar de vroegprehistorische vindplaatsen op de locaties Olthof-Noord en Olthof-Zuid in Epse-Noord*. Gemeente Deventer, p. 143-162 (Rapporten Archeologie Deventer; vol. 34)

Admiraal, M. 2013. "Early Maritime Adaptations and the Peopling of the Americas," in *A Kaleidoscope of Maritime Perspectives. Essays on the Archaeology, Art History and Landscape History of the Maritime World View*. Edited by D. C. M. Raemaekers, pp. 1-7. Groningen: Groningen Institute of Archaeology & Barkhuis.

FIELDWORK AND OTHER RELEVANT EXPERIENCE:

- 2018 Emerging Leaders program, Arctic Frontiers. January 17-21, Bodo - Tromso, Norway.
- 2016 Archaeological excavation: Kodiak, AK, USA.
- 2012 Invited visit: Bureau of Land Management. Northern Brooks Range, Alaska, USA.
- 2012 Invited visit: Western Cultural Resource Management Inc. Reno, Nevada, USA.
- 2012 Internship (10 weeks) Paleoindian department, National Museum of Natural History, Smithsonian Institute, Washington DC, USA.
- 2012 Committee student member of the Appointments Advisory Committee: Chair Arctic and Antarctic Studies, University of Groningen. *Result: successful appointment prof. Peter Jordan.*
- 2011 Master course: *Permafrost and Periglacial Environments* the University Centre in Svalbard, Spitsbergen
- 2009, 2011 Archaeological excavation: Halos, Greece
- 2008 Archaeological excavations: Grote Markt & Helpermaar, Groningen

Statements to supplement the thesis

The adoption of pottery into the New World

Exploring pottery function and dispersal in Southwest Alaska
through organic residue analysis

Marjolein Admiraal

1. Pottery in SW Alaska was a specialized tool for **aquatic resource processing**.
2. The preservation of pre-firing **manufacture-derived lipids** (due to the addition of organic materials to the clay during manufacture) is minimal in pottery fired at temperatures over 400°C.
3. The high occurrence of stone bowls in the Aleutian Islands at around 3.000 cal BP was a result of climatic instabilities (the Neoglacial). As a result, the Aleut started using stone bowls to **render marine mammal oil** (with direct heating), instead of cold-rendering which is highly dependent on stable temperatures and is costly in time.
4. **Site distribution patterns** of pottery sites in SW Alaska indicate the importance of aquatic resources for both the Norton and Thule cultures. Pottery use is highly dependent on geographical location (coastal vs. riverine). However, coastal pottery is also often used to process salmonids, harvested at large river mouths on the coasts.
5. Pottery was introduced in the New World as part of a Late Neolithic **riverine adaptation** originating in Northeast Asia.
6. The late, and uneven adoption of pottery on Kodiak Island was mainly due to **social boundaries**, also reflected in other material culture and linguistic variability. On Kodiak the uneven distribution of pottery may be connected to Late Koniag whaling practices, as indicated by residue results and the distribution of contemporaneous whale remains.