Investigate the Shore, Sound out the Past: Methods and Practices of Maritime Prehistory
Explorer la côte, sonder le passé : méthodes et pratiques de la préhistoire maritime
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Empty Edges? Ten Years of Searching for Prehistory on the Atlantic Coasts of Scotland

Une bordure vide ? Dix ans à la recherche de la Préhistoire sur les côtes atlantiques de l'Écosse

Stephanie F. Piper

Abstract: The Highlands and western islands of Scotland demonstrate great potential to further understanding of prehistoric occupation at the most north-western edges of Atlantic Europe, where intensive research strategies are employed. However, several factors limit archaeological investigation, resulting in large gaps in the record from both a geographic and chronological perspective. This paper presents the different survey and excavation techniques that have been employed in three areas, and the contribution the results have made towards a better understanding of prehistory along the "empty" coastal edges of this remote and under-investigated region. These projects have yielded evidence from late Mesolithic shell middens, buried land surfaces and lithic scatters, to a burnt mound of probable Bronze Age date. Issues of the effects of coastal erosion and heritage protection of prehistoric archaeological sites with no upstanding remains unite these projects and are discussed in relation to national and regional archaeological frameworks.
Keywords: Scotland, Mesolithic, Early Neolithic, Bronze Age, burnt mound, lithic scatter, coastal erosion, walk over survey, survey methodology, research framework.

Résumé : Les Highlands et les îles occidentales de l'Écosse présentent un fort potentiel pour améliorer notre compréhension de l'occupation préhistorique des régions les plus septentrionales de l'Europe atlantique. Cependant, un certain nombre de facteurs ont limité les recherches archéologiques et de nombreuses lacunes subsistent, aussi bien géographiques que chronologiques, subsistent. Cet article présente les progrès réalisés et les défis relevés grâce à différentes méthodes de recherche et techniques de fouille appliquées dans trois zones au cours de dix années de travail de terrain. Les résultats qui en découlent nous offrent une meilleure compréhension de la Préhistoire des côtes de cette région septentrionale, éloignée et peu étudiée.

Dans le nord-ouest de l'Écosse, les indices d'une occupation préhistorique précoce sont très rares et souvent profondément enfouis sous la tourbe ou des dunes de sable (machair). Par conséquent, les techniques traditionnelles de prospection archéologique non invasive, telles que l'étude géophysique et la prospection de terrain, sont inefficaces. De plus, il existe peu de grands projets d'infrastructure susceptibles de faciliter l'identification de nouveaux sites dans le cadre de fouilles préventives financées par des promoteurs.

Dans cet environnement exposé à l'Atlantique, les menaces qui pèsent sur le patrimoine côtier, en raison des changements climatiques et des aléas naturels, constituent une préoccupation majeure pour la gestion future des ressources archéologiques. Les risques les plus importants pour la zone des Highlands sont la variabilité extrême des précipitations, qui provoque des inondations, et l'instabilité du sol, car le ralentissement du soulèvement isostatique ne compense plus l'élévation croissante du niveau de la mer.

Des études antérieures ont intégré l'érosion dans leurs méthodologies pour détecter de nouveaux sites préhistoriques. Les trois projets présentés ici appliquent ces méthodes et les modèles prédictifs existants pour détecter des occupations préhistoriques dans des environnements côtiers où leurs traces sont rares.

Le premier projet a été mené dans les Hébrides extérieures. Des amas de coquillages de la fin du Mésolithique et des surfaces d'occupation contenant des éclats lithiques, des foyers et des restes fauniques ont été découverts sur plusieurs années en raison de l'érosion côtière. Ces sites sont disposés selon le *Danish fishing site model* et fournissent des preuves rares de la préservation des matières organiques.

Le deuxième projet, sur l'île de Muck, dans les îles Small, a permis d'identifier des assemblages lithiques et des poteries dans des puits

de sondage, à proximité de baies abritées. Ces assemblages indiquent une occupation datant du Mésolithique et du Néolithique-âge du Bronze, venant compléter les précédentes découvertes : des restes lithiques hors stratigraphie et une épée datant de l'âge du Bronze. Les faibles concentrations au sein d'un horizon stratigraphique homogène semblent toutefois représenter un « bruit de fond » plutôt que de véritables zones d'activité. Il semble que l'absence de couverture protectrice de la tourbe ou du machair ainsi que la longue histoire de cultures des sols aient considérablement perturbé les sites préhistoriques.
Dans le troisième projet, une prospection de terrain a été menée sur une section de la côte de Wester Ross, en Écosse continentale. Un monticule brûlé, datant probablement de l'âge du Bronze, a été identifié par la découverte de fragments lithiques et de pierres brûlées, dans une section érodée par le passage du bétail et le glissement du sol. Au cours des fouilles, dans les surfaces d'occupation identifiées sous le monticule, du charbon de bois a été récupéré et daté. Les datations radiocarbone du site ne sont postérieures que d'environ 200 ans aux premières dates néolithiques de la région des Highlands, en Écosse. Ces résultats sont particulièrement importants, étant donné que les vestiges néolithiques solidement datés dans la région sont presque absents. Le travail de post-fouille, en cours, permettra d'approfondir la compréhension de ces monuments, particulièrement rares dans l'ouest de l'Écosse.
L'impact de l'érosion côtière et la protection du patrimoine des sites archéologiques côtiers préhistoriques sont au cœur de ces projets. L'érosion est indéniablement dommageable pour l'environnement naturel, mais l'exposition causée par ces processus peut être utilisée pour faciliter la recherche de sites et de paysages archéologiques souvent profondément enfouis et difficilement détectables en surface. Il est reconnu que si les stratégies de prospection employées sont systématiques, la nature de l'érosion ne l'est pas. Ainsi, les mêmes régions doivent être fréquemment réexaminées à mesure que l'érosion se poursuit. La compréhension de la géomorphologie locale, combinée à la connaissance des zones à haut risque d'érosion, peut alors être utilisée pour développer des méthodologies prédictives qui facilitent une approche d'investigation plus ciblée et une surveillance active.
Mots-clés : Écosse, Mésolithique, Néolithique ancien, âge du Bronze, monticule brûlé, érosion côtière, prospection pédestre, méthodologie de prospection, cadre de recherche.

INTRODUCTION

The coasts and islands of western Scotland present highly enigmatic archaeological evidence regarding early prehistoric occupation at the edges of the European continent. Until recently, in situ evidence for an Upper Palaeolithic presence was unknown (Mithen et al., 2015; Hardy et al., 2020); Mesolithic occupation of the Western Isles remained speculative (Edwards and Mithen, 1995; Gregory et al., 2005); and chronologies for the Atlantic spread of Neolithic lifeways to the area still lack resolution (Whittle et al., 2011; Garrow et al., 2017). It is a region that has remained comparatively empty in our understanding, but the extent to which this reflects true absence of prehistoric populations or, more likely, bias in research activity remains unresolved.

In this exposed Atlantic environment, threats to Scotland's coastal heritage from the effects of changing climate and natural hazards are a significant priority in the future management of the archaeological resource (Harkin et al., 2018). Coastal Zone Assessment Surveys (CZAS) conducted between 1996-2010 recorded threat levels to archaeological sites, yet only cover 30% of the Scottish coastline (Dawson, 2010). The Historic Environment Scotland Climate Change Risk Assessment indicates that in the coastal Highland region, the greatest risks are twofold: more extreme variation in precipitation has implications for flooding and instability of sloping ground; and slowing isostatic uplift no longer offsets increasing rates of sea level rise (Rennie and Hansom, 2011; Harkin et al., 2018, p. 37-39). This assessment only accounts for properties in its care however, of which there are few in the Highlands and Hebridean islands (Harkin et al., 2018, p. 8). These reports nevertheless provide a baseline for the impact of erosion in the coastal zone and highlight areas where such information is lacking.

In north-west Scotland, the evidence for early prehistoric occupation is highly ephemeral and often deeply buried. The Highlands are dominated by mountains, heathland, and peat formations up to 7 m deep; substantial tracts of managed forestry cover 13% of the region (The Scottish Government, 2011, Annex C; The Highland Council, 2018). This severely limits the use of traditionally non-invasive survey methods to identify new archaeological sites without upstanding remains (Edwards and Mithen, 1995, p. 349). Furthermore, developer-funded rescue excavations favour the urbanised central belt and east coast (Phillips and Bradley, 2004, p. 20).

Whilst much of south-western Scotland is undergoing isostatic uplift, other areas are experiencing marine transgression. The zero isobase for the Main Postglacial Shoreline cuts a north-easterly trend through the centre of Skye and the north-western coastline of Wester Ross (fig. 1; Smith et al., 2000, p. 499). In the Western Isles, the Mesolithic shoreline c 6200 cal. BC may have been c -2.17 m to -5 m OD than at present (Jordan et al., 2010, p. 131). Here, the inland incursion of machair (calcareous shell sand) dunes have buried some coastal regions in the same way peat formations have inland, paradoxically providing ideal preservation conditions for organic remains, where the acidic peats do not (Edwards and Mithen, 1995).

This combination of factors means the early prehistoric archaeological record of western Scotland often goes undetected or unrecognised and is therefore extremely vulnerable to loss. Despite these challenges, erosive processes have also played an important role in exposing invisible sites, often with excellent levels of preservation, especially after periods of extreme weather (Dawson, 2010; Atkinson and Hale, 2012, p. 48; Hambly, 2017).

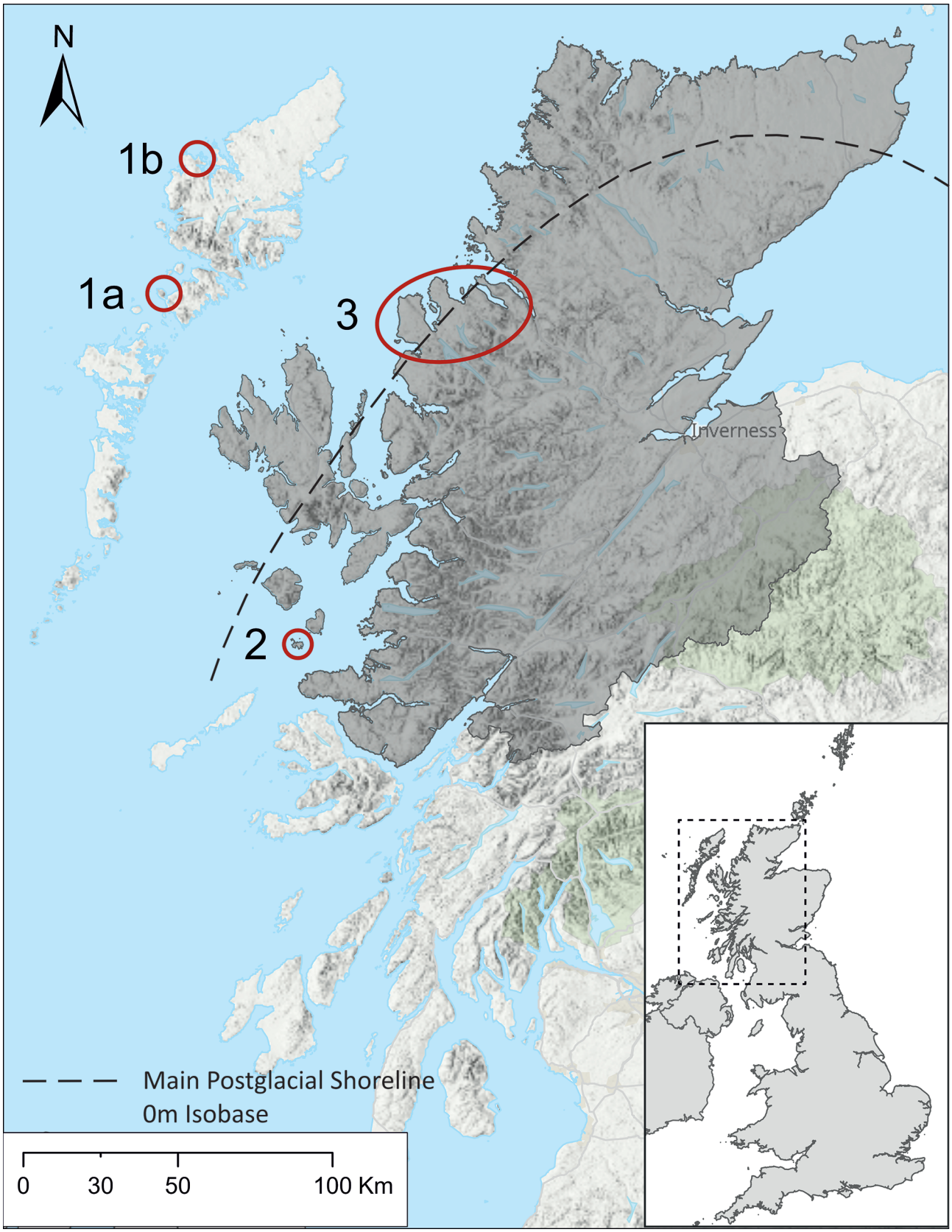

Fig. 1 – Project locations. Western Isles Mesolithic Project: Harris (1a); Lewis (1b). Early Prehistoric Maritime Communities of Western Scotland, Muck (2); CAERoS (3). The Highland Council area is shaded dark grey
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***Fig. 1** – Sites présentés dans le projet. Projet mésolithique sur les Hébrides extérieures : Harris (1a) ; Lewis (1b). Premières communautés maritimes préhistoriques de l'ouest de l'Écosse : Muck (2), îles Small ; CAERoS (3).*
La zone du Highland est colorée en gris foncé.

1. EROSION AS A RESEARCH METHOD IN WESTERN SCOTLAND

Discoveries of buried early prehistoric sites in western Scotland have primarily arisen from intensive research strategies of survey and test-pitting in exposed coastal locations of the mainland and islands. Over the last twenty-five years concentrated investigations, with a particular focus on the Mesolithic period, have resulted in a corpus of new archaeological data that has substantially broadened our understanding of hunter-gatherer occupation in this corner of Europe. Such examples include the Scotland's First Settlers (SFS) project which targeted the coasts of Skye and the Inner Sound, identifying 129 new archaeological sites, of which 48 were prehistoric (Hardy and Wickham Jones, 2009), and the Inner and Southern Hebrides Mesolithic projects (Mithen, 2000; Mithen et al., n.d.).

These projects have collectively implemented inspection of all forms of erosion as part of their research strategies, successfully yielding new evidence for prehistoric activity both inland and on the coast. Erosion events may be natural, for instance along rivers where sections cut by fluvial processes expose buried ground surfaces and wash out material (e.g. Edwards et al., 1983; Piper et al., 2018), or movement of sand dunes (Dawson, 2010); human, including footpaths, tracks, peat and drainage cuttings (e.g. Hardy and Wickham-Jones, 2009, p. 49; Mithen, 2000, p. 57-60); or animal induced. On Skye, a Mesolithic lithic scatter was exposed in a "scrape", a deliberate hollow made by sheep for shelter (Kozikowski et al., 1999).

2. INVESTIGATING THE "EMPTY EDGES"

Despite the achievements of heritage assessments and research projects in raising awareness of Scotland's fragile coastal archaeology, there are still large gaps that remain both chronologically and geographically. Over the last ten years, three new projects have sought to find evidence with which to populate these "empty edges" with their earliest prehistoric inhabitants. Individually, their primary aim was to identify Mesolithic activity, yet each has also shed new light on other periods of prehistory that are equally underrepresented in the western Highland region, specifically the Western Isles, the Small Isles, and Wester Ross (fig. 1). Their results reinforce existing predictive models, whilst informing development of regionally specific field survey methods.

2.1. The Western Isles Mesolithic project

Until 2001, no definitive archaeological evidence existed for Mesolithic occupation in the Western Isles, despite hints at a possible Mesolithic lithic scatter at Traigh na Beirigh, Lewis (Lacaille, 1937). Only palaeoenvironmental indicators of vegetation disturbance suggested any human activity on these islands (Edwards and Mithen, 1995, p. 349-350). This was in stark contrast to the numerous sites known from the Inner Hebrides and south-western mainland.

The first confirmed site at Northton, Harris was identified below a later prehistoric Scheduled Ancient Monument in 2001. It comprised a buried ground surface containing an assemblage of lithics, burnt faunal material and hazelnuts dating to 7060-6100 cal. BC (Gregory et al., 2005; Simpson et al., 2006). Further fieldwork from 2010-2012, led by Prof M. Church, established that serious erosion had almost destroyed the later prehistoric settlement and encroached on the Mesolithic deposits (fig. 2-A). Ensuing excavation consolidated evidence for Mesolithic activity, including lithic working, fish processing, hunting, and gathering activities at the site. Sampling along the eroding coastal edge and a borehole survey indicated the buried ground surface extends across an area at least 50 m along the coast and 40 m into the interior (Gregory et al., 2005; Bishop et al., 2010a and 2011; Ascough et al., 2017).

Between 2011-2012, another exposure of a relic land surface was observed less than 500 m to the north-east of Northton, at Tràigh an Teampuill. The eroding deposits spanned c 5 m in width and were buried beneath substantial machair accumulation (fig. 2-B). These yielded a similar suite of Mesolithic occupation debris to Northton, albeit a millennium later in date (Church et al., 2012a).

On Lewis, prior survey of the Bhaltos peninsula had recorded a shell midden of undetermined date on a rocky promontory at the western edge of Tràigh na Beirigh beach (Armit et al., 1995, p. 90). The CZAS highlighted the site's significant risk of destruction (Burgess and Church, 1997, p. 117; Church and Burgess, 2003, p. 61). In 2011, a coastal erosion assessment determined that almost the entirety of the midden (TnB1) had eroded due to its exposed location; it was excavated in full the following year and produced a late Mesolithic date of 4330-4240 cal. BC (Church et al., 2012b; Ascough et al., 2017).

Owing to the dynamic dune systems in the area, the headland adjacent to Tràigh na Beirigh beach was surveyed over consecutive years, from 2011-2013. In the first year, nothing was observed. However, in 2012 a shell midden and buried soil horizon (TnB2) was seen underlying the eroding machair dune (fig. 3-B). Mesolithic occupation at this site dates to 4540-4470 cal. BC (Church et al., 2012b; Bishop et al., 2013; Ascough et al., 2017). Repeated survey alongside further excavation of TnB2 identified several more exposures of shell midden deposits, another of which dates to the late Mesolithic (TnB9), with two others containing undiagnostic knapped quartz (fig. 3-A; Snape-Kennedy et al., 2013; Piper, 2016). These sites were revealed due to the dry summer and aggressive autumn storms that affected the area in 2012. An additional eroding Mesolithic midden was recorded on the neighbouring island of Pabaigh Mòr, following a report by a local resident (Church and Rowley-Conwy, 2013).

Fig. 2 – A: The eroding Mesolithic ground surface and overlying later prehistoric deposits at Northton, Harris (trench extent indicated by the dashed line). B: Sampling underway at Tràigh an Teampuill (photos P. Rowley-Conwy).

***Fig. 2** – A : Surface d'occupation mésolithique en cours d'érosion et dépôts préhistoriques ultérieurs qui la recouvrent, Northton, Harris (la zone de fouille est indiquée en pointillés). B : Échantillonnage en cours à Tràigh an Teampuill (clichés P. Rowley-Conwy).*

Fig. 3 – A: The cliff-face location of three eroding Late Mesolithic shell middens at Tràigh na Beirigh, peninsula, Lewis (photo P. Rowley-Conwy). B: Tràigh na Beirigh 2 under excavation. The Mesolithic ground surface is sealed below substantial machair formation (photo M. Church).

***Fig. 3** – A : Emplacement à flanc de falaise des trois amas coquillers du Mésolithique tardif, en cours d'érosion à Tràigh na Beirigh, Lewis (cliché P. Rowley-Conwy). B : Tràigh na Beirigh 2 en cours de fouille. La surface d'occupation mésolithique est scellée sous une importante formation de machair (cliché M. Church).*

The occupation surfaces on Harris and middens on Lewis present distinctly different site types, separated in time by almost two millennia. Despite this, they share two features that are invaluable to building a methodology by which other sites may predictably be found. Firstly, their topographic location on headlands associated with sheltered bays. These are analogous to scenarios *C* and *D* of the Danish "fishing site location model" (fig. 4; Fischer, 1995, p. 373-374). Although this model cannot be directly exported to western Scotland due to the differences between the coastal landscapes, and its origins in favoured present-day passive fishing locales, a similar model may be developed for Scotland based on local conditions. Second is their geomorphic position. The relic ground surfaces are preserved atop steep, rocky platforms, thus far guarding against inundation. Apart from TnB1, machair formation has generally protected against later disturbance, and offers alkaline conditions that favour organic preservation (Barber, 2011, p. 50).

2.2. Early Prehistoric maritime communities of western Scotland, Muck, Small Isles

The isle of Muck, Small Isles, presents a very different environment to much of the Highland and island region, instead dominated by rich soils that have been extensively cultivated. Whilst retaining the strategy developed in the Western Isles of targeting several coastal embayments, the project implemented systematic test-pitting, over three seasons from 2016-2018 (Piper et al., 2019). One inland location was also chosen based on prior known later prehistoric lithics (NMR: NM48SW 48-50) and a Bronze Age sword (HER: MHG3982).

The lithic and pottery assemblages recovered from the test pits indicate Mesolithic and Neolithic-Bronze Age presence, consolidating the evidence for prehistoric activity on the island across a wider area than previously recognised. The low concentrations within a homogenous sub-soil horizon appear to represent "background noise" however, rather than definitive activity areas. Without the protective coverage of peat or machair, and the islands' long history of cultivation, it seems any prehistoric sites have been substantially disturbed.

The presence of worked Rùm bloodstone within the lithic assemblages demonstrates connections between Muck and its larger island neighbour for the supply of lithic raw material and supplements the evidence for regional distribution of this raw material during early prehistory (fig. 5; Ballin, 2018; Piper et al., 2019)

2.3. Coastal Archaeology and Erosion in Wester Ross

Project CAERoS (Coastal Archaeology and Erosion in Wester Ross, Scotland) was initiated in 2019 with the aims of establishing the potential of eroding coastlines to yield new early prehistoric sites and contribute to monitoring of archaeological sites at risk of erosion (Piper et al., 2020; Piper, forthcoming). The targeted area encompasses three peninsulas from Gairloch to Ullapool, between the areas surveyed by the SFS project and the Ullapool-Lochinver CZAS (fig. 6). Both surveys have documented buried and upstanding sites of prehistoric date (Long, 1996; Hardy and Wickham-Jones, 2009), however desk-based assessment of the Historic Environment Record (HER) indicated few records exist for early prehistoric occupation in this region. This suggested high potential for CAERoS to fill a significant gap in the known distribution of prehistoric sites along the coastline of the Highlands.

2.3.1. Walk-over survey

The primary focus of the survey was to identify new prehistoric sites, however archaeological remains of any date within c 50 m of the coastline were also noted in relation to their state of preservation. To maximise the likelihood of identifying buried early prehistoric sites, any area of erosion in this zone was inspected following the methods of the SFS and Western Isles Mesolithic projects. The first phase focussed on the Melvaig and Rubha Mòr peninsulas around Loch Ewe and Gruinard Bay, Gairloch parish.

A total of 25 sites from the HER were visited, ranging from prehistoric hut circles to World War II infrastructure associated with the Russian Arctic Convoys (Chadwick, 2014). None of these sites are at risk of active erosion, however vegetation overgrowth is causing structural instability. The survey also identified several unrecorded sites, predominantly of post-medieval to modern date.

A single site indicating evidence for prehistoric occupation was identified at Uamh Mhòr, Cove. Here, an exposure of burnt material including heat-affected rocks and undiagnostic lithic debris was observed in a sheep "scrape", situated on the eroding edge of a field above a small, sheltered bay facing north-east across Loch Ewe. Aerial imagery from 2014 shows substantial erosion from a recently infilled stream (fig. 7; Piper et al., 2020).

2.3.2. Excavation

A trench contiguous to the eroding edge was subsequently excavated (fig. 8). The curvilinear edge of a dome-shaped deposit of charcoal-rich, black sandy silt was identified overlying a series of sandy-silt deposits with lenses of charcoal and reddened sediment, indicating multiple burning episodes (Canti and Linford, 2000). A thick basal horizon of sterile sand overlies Torridonian sandstone bedrock. This was reached in a 1 m-wide sondage at the south-east extent of the trench; the north-western area is partly truncated by the backfilled stream. A test pit situated 1 m from the south-western corner of the trench confirmed the continuation of the burnt deposit in this direction.

The uppermost burnt deposit comprises frequent heat-affected rolled beach cobbles, a quartz-dominated lithic assemblage, hammerstones, and a small number of minute pottery fragments. Lithics were also recovered from the underlying deposits, in addition to two large pieces of charcoal of a size suggesting possible burnt stakes (Elliott pers. comm.). A fragment from one, iden-

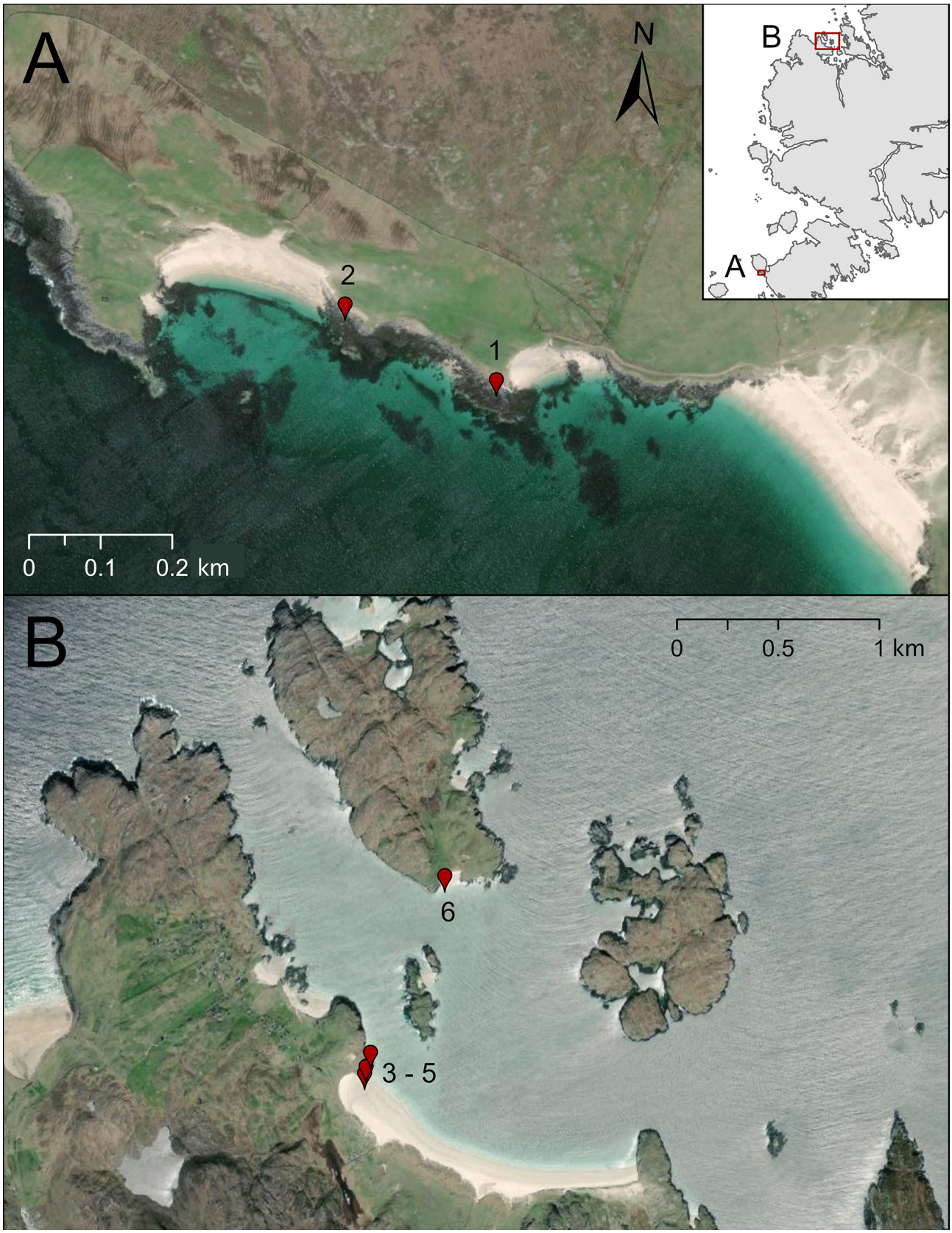

Fig. 4 – Location of the Mesolithic sites in the Western Isles conforms to the Danish "fishing site model". A: Harris, 1 – Northton, 2 – Tràigh an Teampuill; B: Lewis, 3-5 – Tràigh na Beirigh 1, 2 and 9; 6 – Pabaigh Mòr South (Aerial imagery: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

***Fig. 4** – Emplacement des sites mésolithiques dans les Hébrides extérieures, conforme au « Danish fishing site model ». A : Harris, 1 – Northton, 2 – Tràigh an Teampuill ; B : Lewis, Tràigh na Beirigh 1,2 et 9; 6 – Pabaigh Mòr Sud.*

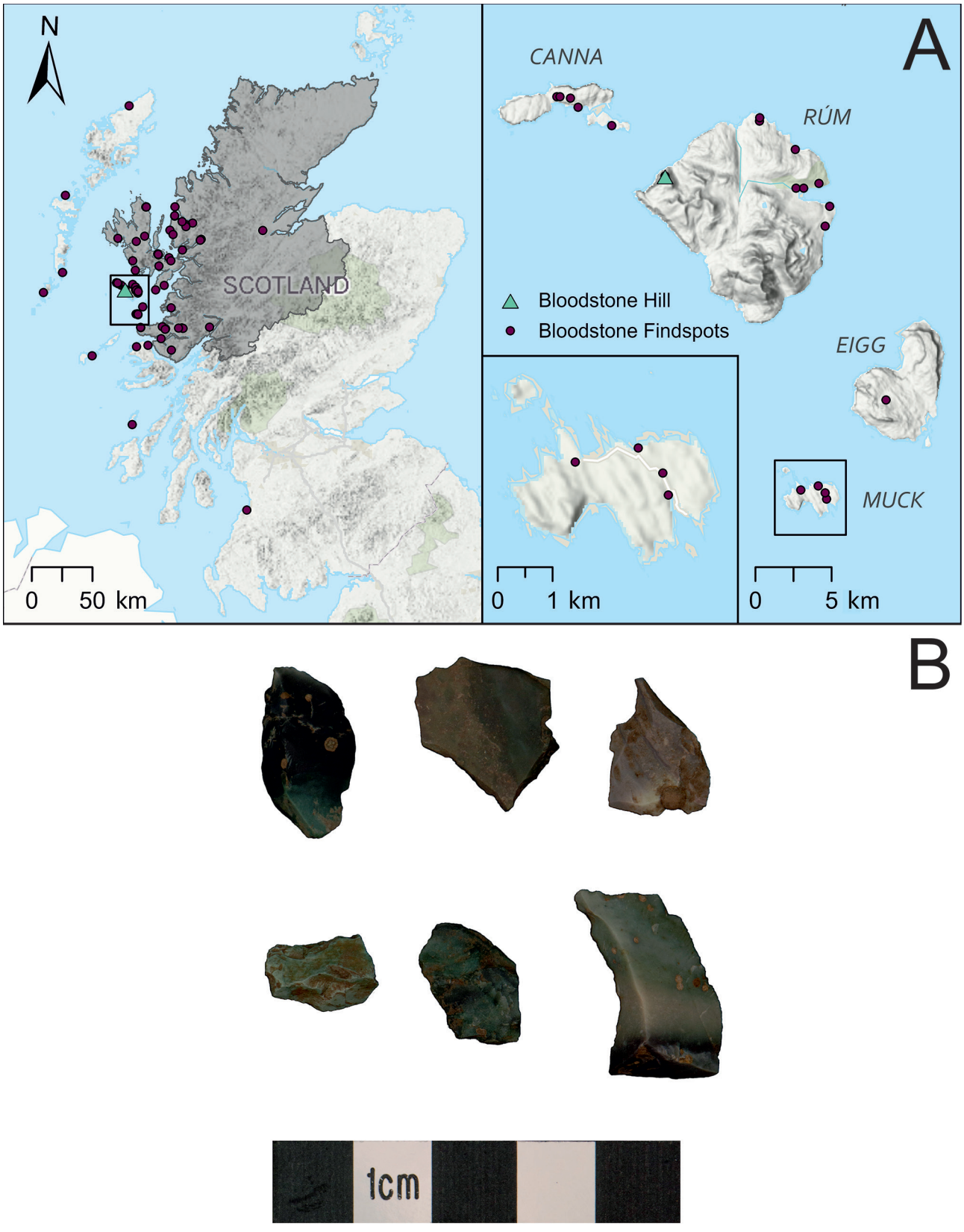

Fig. 5 – A: Regional distribution of bloodstone lithic findspots relative to the source at Bloodstone Hill, Rùm (after Piper, 2016; Ballin, 2018; © Crown copyright and database right 2021 Ordnance Survey). B: Worked bloodstone from Muck (photo N. Gray).

***Fig. 5** – A : Distribution régionale des découvertes d'héliotrope (« pierre de sang ») provenant du gisement de Bloodstone Hill, Rùm (d'après Piper, 2016 ; Ballin, 2018). B : Héliotropes taillées de Muck (cliché N. Gray).*

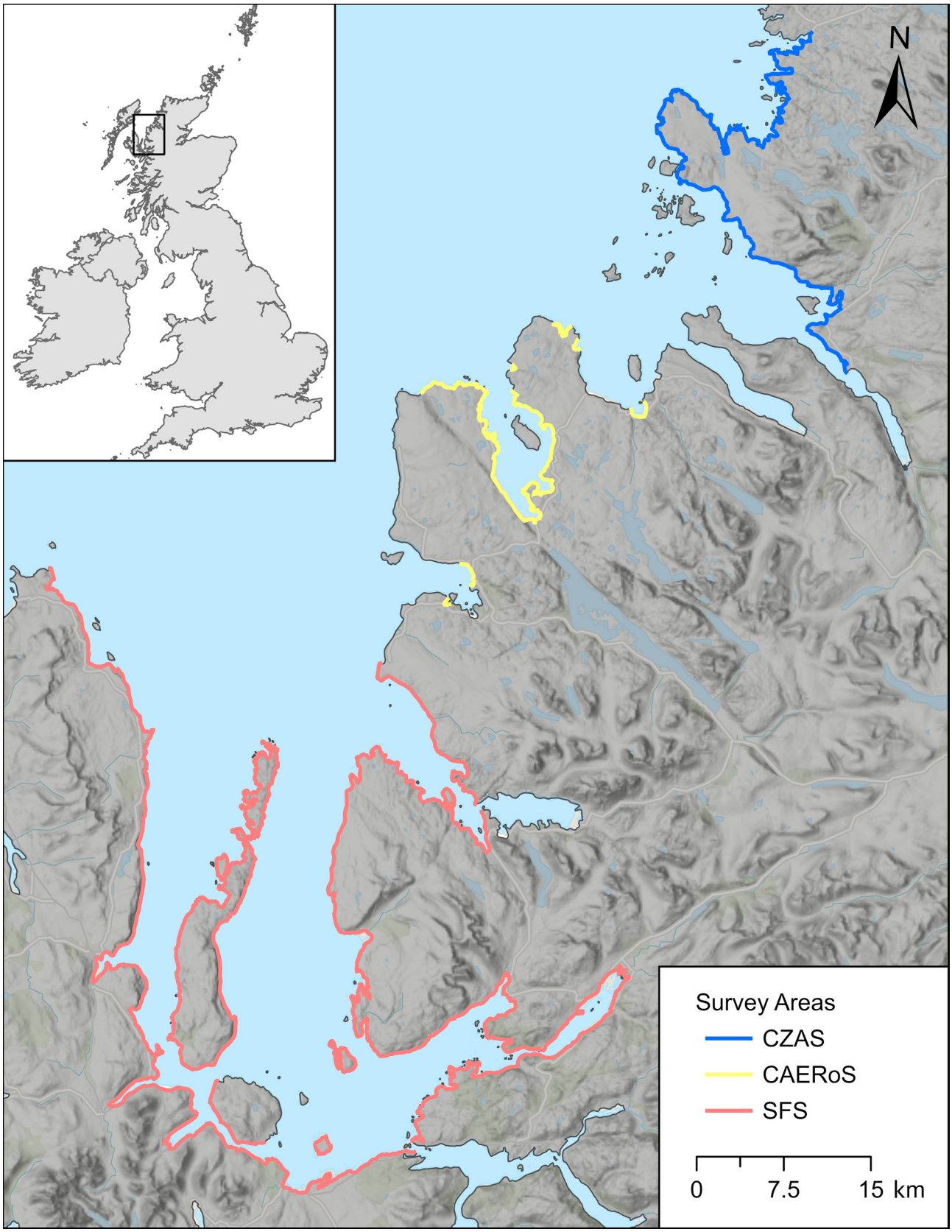

Fig. 6 – Extent of the survey conducted by the CAERoS project, which aims to fill the gap between the Scotland's First Settlers (SFS) and Ullapool-Lochinver CZAS surveys (© Crown copyright and database right 2021 Ordnance Survey).

Fig. 6 *– Étendue de la campagne menée par le projet CAERoS, destinée à combler le fossé entre les études Scotland's First Settlers (SFS) et Ullapool-Lochinver CZAS.*

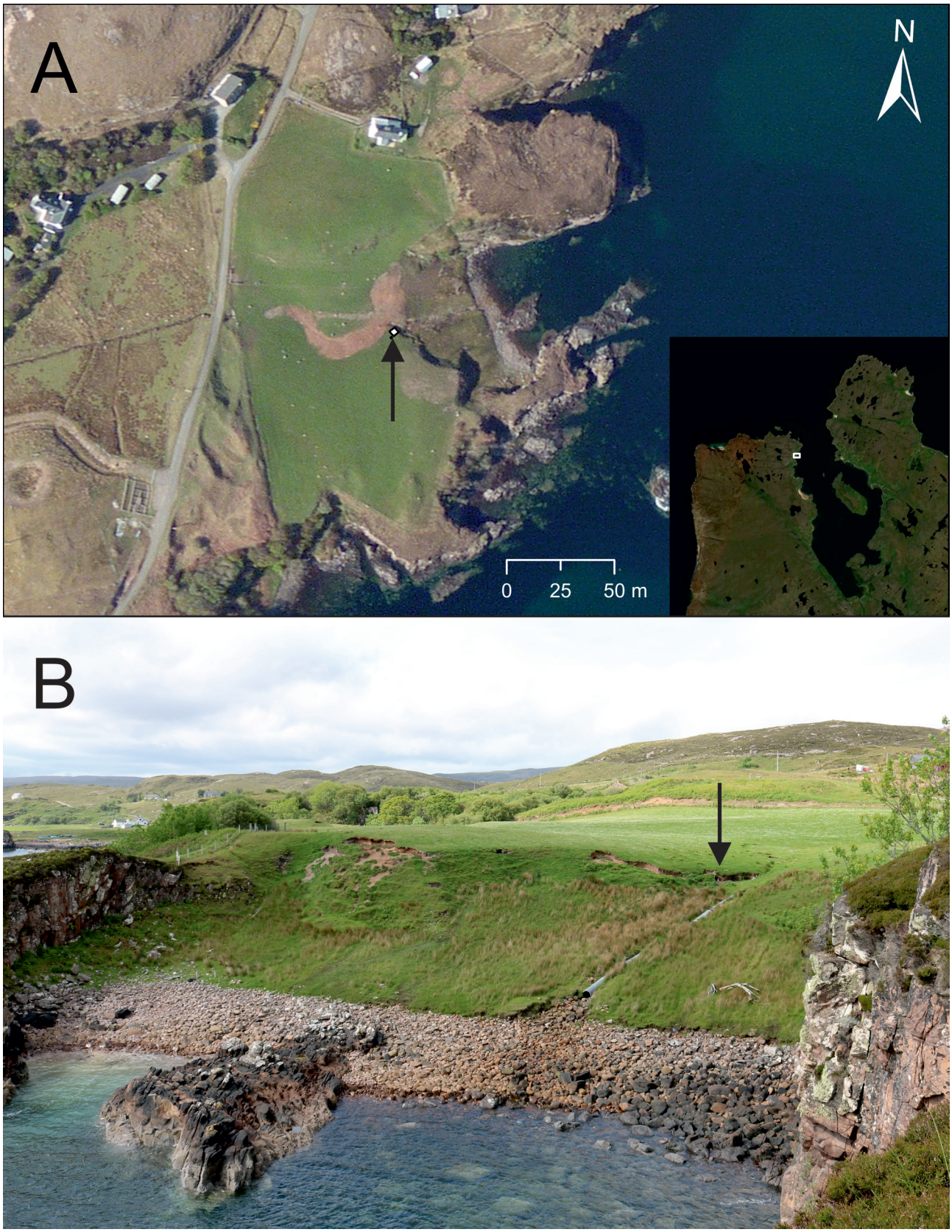

Fig. 7 – Location of the excavation at Uamh Mhòr (arrowed). A: In relation to aerial imagery from 2014 showing the infilled course of the stream (aerial imagery: Esri, DigitalGlobe, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, and the GIS User Community). B: Along the present eroding edge (photo F. Martínez Sevilla).

***Fig. 7** – Localisation de la zone de fouille à Uamh Mhòr (flèche). A : Image aérienne de 2014 montrant le tracé du ruisseau remblayé (Esri, DigitalGlobe, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, et communauté des usagers du SIG). B : Localisation actuelle du site en bordure de la ligne d'érosion (cliché F. Martínez Sevilla).*

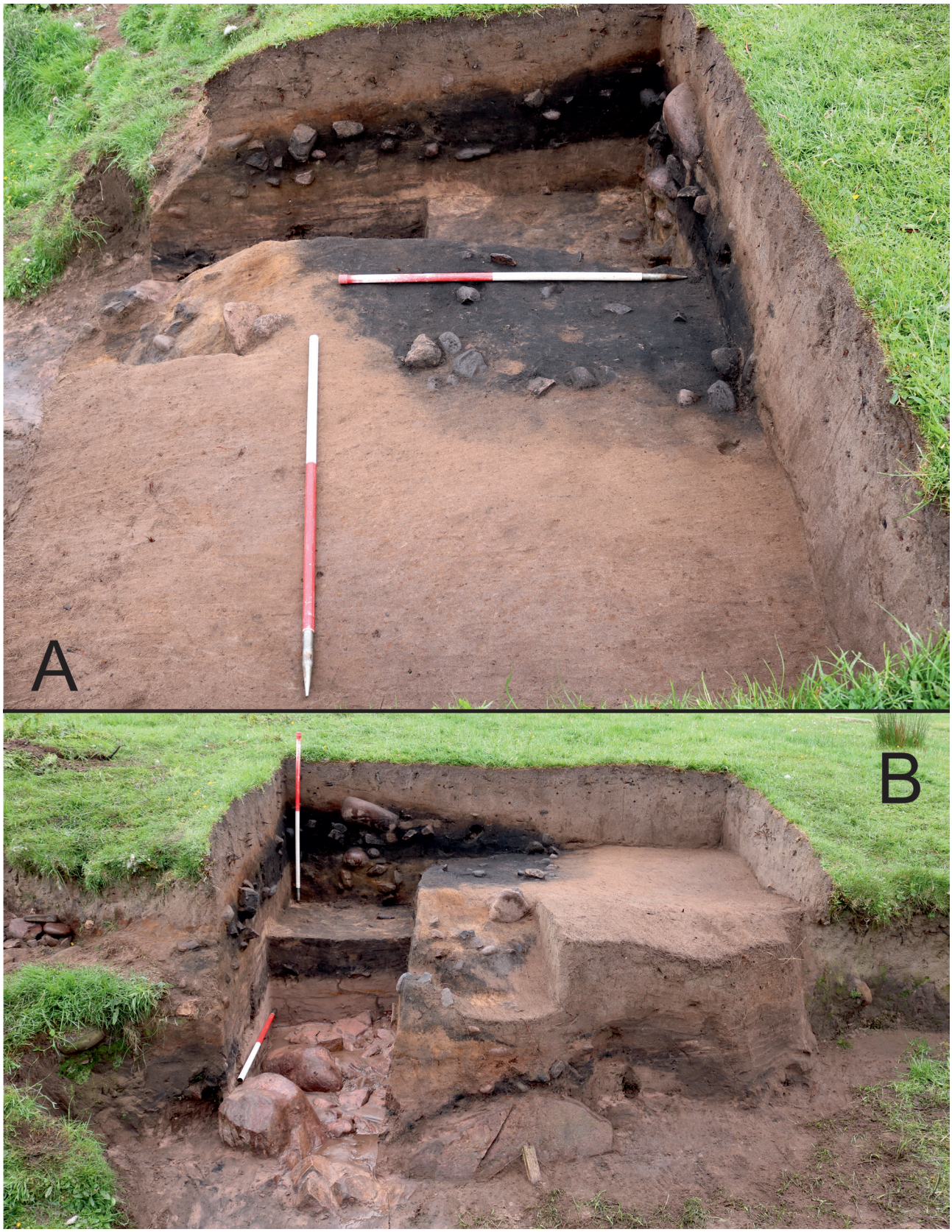

Fig. 8 – Uamh Mhòr under excavation. A: The dark sediment of the burnt mound exposed in the southern extent of the trench, facing south-east. B: Showing the upper deposits of the burnt mound and lower Early Neolithic deposits exposed in the sondage, overlying the sterile basal sand, facing south-west (photos F. Martínez Sevilla).

***Fig. 8** – Uamh Mhòr en cours de fouille. A : Sédiments foncés du monticule brûlé visibles dans la partie sud de la zone de fouille (cliché orienté sud-est). B : Dépôts supérieurs du monticule brûlé et dépôts inférieurs du Néolithique ancien recouvrant le sable basal stérile (orientation sud-ouest ; clichés F. Martínez Sevilla).*

tified as *Alnus glutinosa* was dated 4974 ± 19 BP (3794-3665 cal. BC at 95.4% SUERC-88580 [GU52362]; OxCal v4.4.4, Bronk Ramsey, 2009; IntCal20 atmospheric curve, Reimer et al., 2020). Despite disturbance to some areas of the site through rabbit burrowing, it is highly unlikely the charcoal is redeposited due to its size (c 0.15 m long), positioned at the sharply defined interface of the sterile basal sand and overlying deposits.

Uamh Mhòr is interpreted as a burnt mound of probable Bronze Age date, with underlying early Neolithic activity. Burnt mounds are a ubiquitous, albeit poorly understood, prehistoric monument type in Scotland. Dense concentrations exist in the Northern Isles and eastern counties of Caithness and Sutherland, undoubtedly reflecting the surveys of the Royal Commission. Conversely, their distribution in the west is sparse (fig. 9). Only 38 (10%) are in the western Highlands, with five in the CAERoS project area. For this reason, a burnt mound at Ashaig, Skye has recently been Scheduled (HER: MHG5303/SM13721). It is likely "greater concentrations may exist [in the west] than are currently recognised" (Downes, 2012, p. 52). Modelling of C^{14} and thermoluminescence dates from Scottish burnt mounds has also shown that these monuments are not restricted to the Bronze Age and have a wider temporal span (Anthony et al., 2001, p. 922). Future investigation at Uamh Mhòr, including dating of the mound, will contribute valuable information in line with much-needed further research on these sites, particularly in this under-represented area (Downes, 2012, p. 53-54).

The date for the underlying deposits is significant, providing a *terminus ante quem* for activity at the site that falls within the first 200 years of the Neolithic in western Scotland (Whittle et al., 2011; Sheridan and Pétrequin, 2014). Securely dated evidence for Early Neolithic settlement along the north-west mainland is near-absent (fig. 9), therefore Uamh Mhòr has the potential to provide a major contribution to a key research priority for this period in the Highlands (Sheridan and Brophy, 2012, p. 77).

4. REFLECTIONS AND CONCLUSION

Identifying early prehistoric occupation in coastal north-west Scotland is beset by numerous challenges. Despite such complications the results of these three projects demonstrate beyond any doubt that the potential to find new archaeological evidence along its apparently "empty edges" is very high. The present scarcity is clearly due to a lack of targeted research and invisible archaeology, rather than an absence of people in the past. Individually, each project is small in scale, yet in combination, they have substantially increased the prehistoric record in the Highland and island regions.

From a methodological perspective, there are several key findings. At a basic level, the tenets of the Danish "fishing site" model work equally well in predicting onshore locations of prehistoric occupation in the coastal zone. The Western Isles Mesolithic project has shown that local geomorphology is crucial to the preservation of sites. Incorporating this to refine the model should increase the success of its application whilst accounting for local variation. This may be adapted further for submerged sites (Hall, 2014).

Only ground truthing can fully test the viability of these predictive models. The Western Isles Mesolithic and CAERoS projects continue to demonstrate the success of combining the model with intensive erosion survey as a low-cost strategy for the identification of new early prehistoric sites in these areas. Where "blind" test-pit surveys have proven to be somewhat effective on Muck and other islands, this method is more time consuming, and logistically and labour intensive when considering the likelihood of identifying a site (Mithen, 2000, p. 57-58).

Sometimes, fieldwork exposes epistemological flaws. One observation from Muck demonstrated how slight variation in the topography of coasts may influence the desirability for occupation. The bay at Port Mòr faces north-west and is protected by a headland. It yielded a comparatively concentrated lithic assemblage. To the west, Camas Mòr was also targeted as it occupies the same position; additionally, there is a substantial Late Glacial raised beach (Emeleus and Bell, 2005), theoretically making it an equally viable candidate to locate early prehistoric occupation. However, there was very little evidence for human activity of any period. This may be explained by the position of the bay and the sheer cliffs of An Stac that rise to the summit of Beinn Airein, the highest point of the island, at the bays' western edge. These cliffs perfectly channel the prevailing south-westerly onshore wind, resulting in highly exposed and unfavourable conditions as experienced by the Camas Mòr excavation team. In the absence of information pertaining to the local vegetation cover or modelling of weather systems for the area in prehistory, this remains speculative; nevertheless, it highlights the complexities of predictive modelling (Grøn, 2018).

A further issue is that such predictive models have the propensity to reinforce an assumption that prehistoric occupation was primarily coastal, when based on prior successes. This is highly problematic, especially since inland areas of the Highlands are equally under-investigated. Moreover, in some locales the Late Glacial and Postglacial palaeoshorelines, preserved as raised beach deposits, are situated further inland and currently protected from coastal erosion (Johnstone and Mykura, 1989). Good evidence for earlier prehistoric occupation exists in these contexts (e.g. Wickham-Jones and Hardy, 2004; Hardy et al., 2020). Future surveys should take both aspects into consideration, with investigation of the interior region likely to provide much-needed evidence for prehistoric occupation beyond the present and palaeo-coasts.

A combination of erosive factors clearly present threats to archaeology in the respective coastal zones of this under-researched region. In the Western Isles sites are actively threatened by inundation and storms, whereas the CAERoS survey observed little evidence for such. Instead, the mound at Uamh Mhòr was exposed by

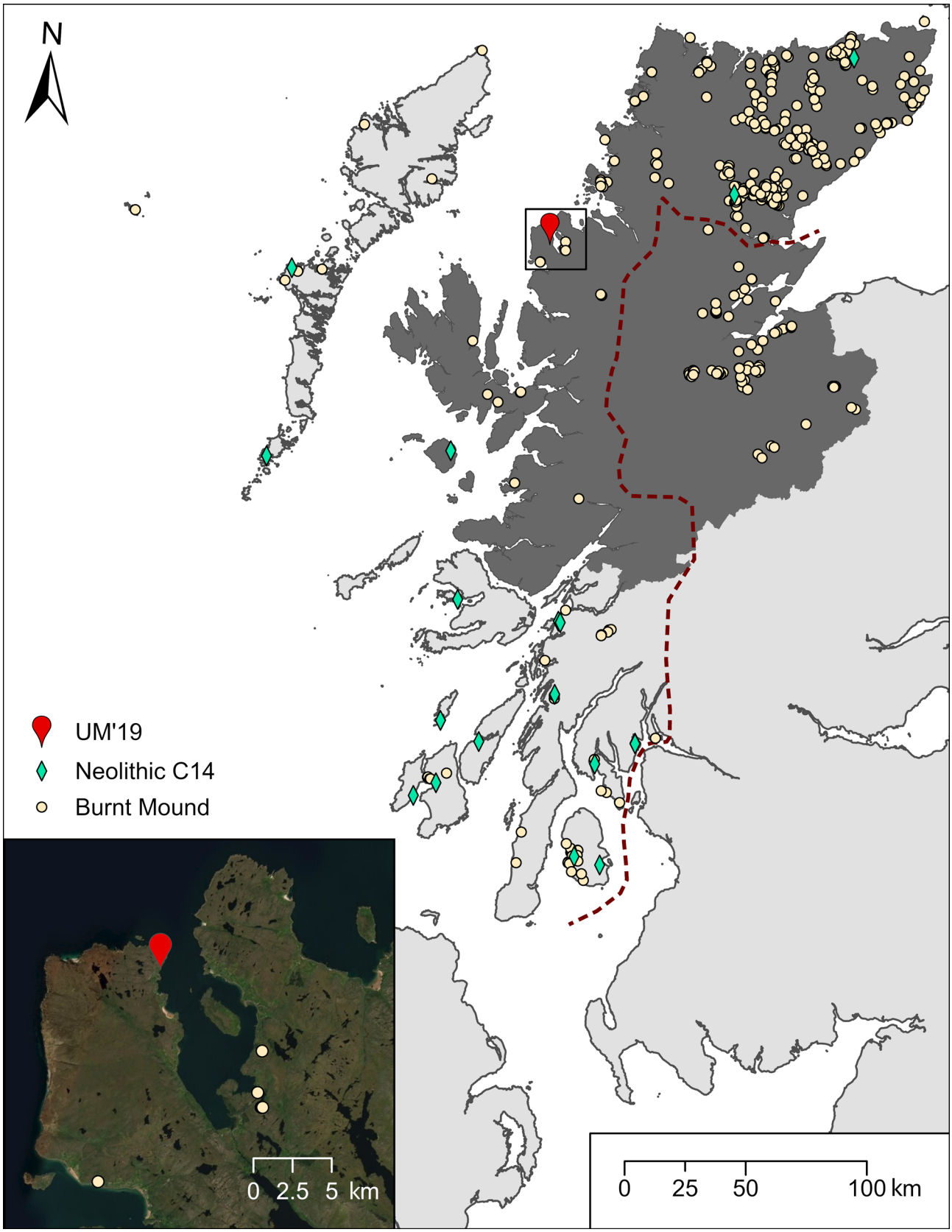

Fig. 9 – Distribution of known and probable burnt mounds, and radiocarbon dated early Neolithic sites in the western Atlantic zone (denoted by the dashed line, sensu Bishop et al., 2010b). All known and probable burnt mounds in the Highlands (dark grey) are included (© Crown copyright and database right 2021 Ordnance Survey; Aerial imagery: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

***Fig. 9** – Répartition des monticules brûlés connus et probables, et des sites néolithiques anciennes datés au radiocarbone dans la zone atlantique ouest (indiquée par la ligne pointillée, sensu Bishop et al., 2010b). Tous les monticules brûlés connus et probables dans les Highlands (gris foncé) sont inclus.*

livestock erosion and ground slippage associated with the nearby watercourse. Future research strategies therefore must not only account for the threat from the sea, but to recognise that the coast is also intensely vulnerable from the landward, due to a variety of natural and anthropogenic factors (Harkin et al., 2018).

Erosion is undeniably damaging the natural environment, however the exposure caused by these processes can be used to facilitate investigation of often deeply buried archaeological sites and landscapes that cannot be detected from the surface. Furthermore, whilst the survey strategies that are employed are systematic, the nature of erosion is not. This therefore requires the same regions to be frequently reassessed as further erosion takes place, as the Western Isles Mesolithic project has shown. Understanding of local geomorphology, in combination with knowledge of areas at high risk of erosion, can then be utilised to develop predictive methodologies that facilitate a more targeted investigative approach and active monitoring.

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