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Knowing-in-Practice, Its Traces and Ingredients

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Introduction

A central insight of practice and process-oriented epistemologies is to emphasise the post-human stance of knowing. Knowledge is not *held* by individual human-beings but *knowing* takes place, to quote Pickering, in a 'thick of things' (Pickering, 2008), together *with* multiple human and non-human actors in an agencement of all entities that engage in a particular practice (Gherardi, 2021). Earlier research has enumerated ways in which different types of things participate in knowing, stabilising, conveying and remembering knowing in action as, for instance, inscriptions (Latour, 1990), traces (Wylie, 2019), ingredients (Smith et al., 2004), archives (Brockmeier, 2018) and mnemonic devices (Carney, 2011). Even if a lot of evidence exists of how such devices are produced (e.g., by writing, building devices and things, keeping stuff), less is known about

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how different epistemic artefacts contribute to knowing in practice (i.e., what exactly is inscribed or written down, why some specific types of materials are kept and others discarded, how they are 'used') and how they differ, work together and eventually complement each other.

This chapter inquires into the complementarities, (dis)similarities and contrasts of two specific types of things—traces and ingredients of how knowing happens—and how they work together and against each other in conveying understanding of past knowledge-making. The discussion draws from an analysis of a corpus of Swedish and French archaeological investigation reports and how they and their contents participate in making archaeological practices and knowing known to their readers. The archaeological report is a specific genre supposed to convey not only the results of an archaeological excavation or field survey but also to provide enough information to allow future archaeologists to understand the specifics of the investigation process and, ideally, to allow for 're-excavation' (e.g., Antonaccio, 2015) that is, to make an investigation transparent to the extent it is possible with often destructive archaeological work. This chapter engages with reports and particular elements in their contents (i.e., information they contain) as parallel traces and ingredients of how knowing of past knowledge-making happens in archaeological practice—literally *in practice*—and investigates how reporting both reduces and contributes to the elusiveness of knowing in and with archaeological fieldwork. The chapter also sheds light on documenting practices and process-based knowing by elucidating how they are documented in archaeological reports and what it implies for knowing either with them or by using them as ingredients of knowing.

Archaeological Documentation and Knowledge-Making

Even if archaeology is both in popular imagination and in disciplinary discourse primarily associated with physical matter and portrayed among others as a 'discipline of things' (Olsen, 2012), archaeology and especially archaeological knowledge are as much defined in social discourse as they

are in direct interactions with material things. Interestingly, many of the long-lasting conundrums of archaeological knowledge-making have close affinities to problems debated in relation to post-epistemologies and specifically in the epistemology of practice. Morgan and Wright (2018) note aptly that archaeological reflexivity is not formed when individuals are interacting with physical stratum but when these interactions are discussed at the edge of a trench. Another often insinuated gap in the fundaments of archaeological knowledge-making lies between (mechanic) collection of *data* and their qualitative interpretation—or as Marila (2017) sees it, between archaeologists' personal knowledge and the processual nature of archaeological research process and its empiricist framing in how it is portrayed in the scientific publication. Such observations underline many of the key tenets of posthumanist practice theory (Cozza & Gherardi, 2023; Gherardi, 2021): sociomateriality of archaeological practice, archaeological knowledge as activity and knowledge-making as agencement. They also decentre archaeologist as the subject in archaeological knowledge-making and underline the importance of accounting for onto-epistemology that is, how archaeological knowledge is made and how epistemic practices construct it and archaeology as whole.

Descriptions of archaeological practices and knowledge work can be found across the archaeological literature and documentation. Quantitatively one of the most numerous genres of such texts is the archaeological investigation report (also archaeological report or field report). They form a distinctive literary genre (Bradley, 2006) with the principle aim of providing a summary of an archaeological investigation and its results based on documentation produced during the process.

The report genre has to a certain extent remained fairly unchanged for several decades (Hamilton, 1999) but has also a lot of variation. Report-writing is steered by (sub-)disciplinary, national and local traditions (Huvila et al., 2021) and documentation ideals (Börjesson, 2016). Reporting and documentation methods vary internationally (Felice, 2008) but also within countries and regions (Magyar, 2013). Most of the reports are released as grey literature through repositories rather than formally published, for instance, in journal articles (cf. Lucas, 2019) or monographs (cf. Lesure, 2015). From a structural perspective, reports can be described as montages (Mickel, 2013). They usually incorporate

several different text types and various visual elements, including maps, plans, diagrams, photographs and lists.

Depending on the size of a fieldwork project, a report can be a result of a large collaborative effort (Hamilton, 1999) or a product of a single individual who did, documented and reported the fieldwork (Huvila et al., 2021). Independent of the number of individuals involved, traditionally, the director of the investigation has been its principal auteur (Huvila, 2017).

Even if archaeological methods literature is adamant about the importance of describing the process that led to the particular observations on site, inadequate documentation (Huvila et al., 2021; Khazraee Afzali, 2014) and communication of archaeological work, and especially the tacit dimensions of interpretation process (Marila, 2017), are an acknowledged problem. Also the granularity of documenting who was involved in the process varies (Huvila et al., 2021) even if archaeologists often emphasise the importance of being able to contact a colleague who was doing the work they try to understand (Koesten et al., 2021).

The propensity to utilise personal contacts to complement reported information depends sometimes on the brevity of documentation but also on the variation between and within sets of documentation (Börjesson et al., 2022), vocabulary and categories (Doerr, 2009), and on how the production of research material—conventionally termed in preposthumanist epistemologies as *data* (cf. Koro-Ljungberg & MacLure, 2013)—is intricately embedded in local traditions, conditions and situations (cf. Koesten et al., 2021). Moreover, as Bucellati (2017, p. 82) notes, besides providing opportunities to contact individuals, knowing who was involved can help a reader to understand, for example, the organisation of work and its underpinning ideals and theoretical views.

Reports have also been criticised for being boring, chronicling rather than narrating the investigation they are describing (Lucas, 2019), and far from 'exciting, or indeed thought-provoking reading' (Hamilton, 1999, p. 5). They have also been arraigned for being cleaned-up of guesswork, iterations and debates (Hodder, 1999). Their style is often formal and they commonly use passive voice (Huvila et al., 2021) to an extent that an investigation might appear to be attributable to 'archaeology' (as an actor) rather than to individual archaeologists (Huvila, 2017). Even if

archaeologists acknowledge that interpretations and knowledge claims documented in reports are contemporary with their making rather than a universal truth (Binford et al., 2013), the report genre is underpinned by a palpable strive to objectivity. Moreover, reports have been criticised to focus on background information rather than on the investigation process and its outcomes, for lacking information on the choice of investigation methods, and for instance, decision-making and technical details of analysis procedures (Gustafsson & Magnusson Staaf, 2001).

A major problem regarding the usability of archaeological reports is that the information can be 'hidden in these texts', difficult to access and utilise (Brandsen et al., 2019; Richards et al., 2015), or from the epistemology of practice perspective, to incorporate in archaeological knowledge-in-practice. Even if important steps have been taken to increase the understanding of archaeological knowledge production (e.g., Beale & Reilly, 2017; Davidović, 2009; Edgeworth, 2006; Wylie, 2017), there is still a lack of comprehensive theoretical and evidence-based understanding of archaeological knowledge practices that is, how archaeologists come to know what they know about research processes, earlier archaeological knowing and knowledge-making (Huvila & Huggett, 2018).

A parallel problem relates to a similarly imperfect understanding of how this particular type of knowledge and its premises are transposed to and encoded in structured sets to information (Börjesson et al., 2022) and 'activated' in writing (Lucas, 2019). Studies of archaeological writing suggest that archaeologists frequently use exemplars (of which some become paradigmatic through stabilisation or consensus), analogies, metaphors, generalisations and developing concepts to help archaeological knowledge travel from one (con)text to another (Lucas, 2019). Wylie (2017) describes archaeologists' use of their earlier and contextual knowledge in constituting new knowledge as scaffolding. As so far much of the work on archaeological knowing has focussed on archaeological knowledge rather than knowledge about archaeological work, the work for improving archaeological documentation and communication of interpretative processes and their underpinnings has similarly focused on new documentation techniques, tools and standards (e.g., Borrego & Fry, 2012; Katsianis et al., 2021; Opitz, 2018; Richards-Rissetto & von

Schwerin, 2017) rather than refining the archaeological knowledge-in-practice as whole.

Even if—and certainly also because of—archaeological reports have been debated and criticised, they unfold as one of the key genres of archaeological writing and documentation of both the results and the archaeological work itself. Apart from being informative within specific archaeological communities, Huvila (2016) describes how they function as boundary objects coordinating activities and facilitating understanding between multiple archaeological and archaeology-related communities. He has also underlined the significance of the face-work of conveying a clean and uncontroversial narrative in the reports (Huvila, 2011), a trait Bornemark (2018) describes in her critique of 'paperified' management culture as the importance of not doing wrong rather than doing right. The prioritisation of uncontroversiality links also to the earlier discussed tendencies to collectivise and in practice anonymise reporting rather than naming individuals (Huvila, 2017). In the reports, the contents and writing are beyond doubt the central carriers of meaning. However, similarly to how Gosden (2013), following Alfred Gell (1998) and Richard Seaford (2004), underline the crucial role of historical artefacts in archaeological knowledge production, it is evident that also the material qualities of reports are similarly entangled in archaeological knowledge-in-practice. A report might not be satisfactory as an independent end-product of archaeological knowledge production (Praetzellis et al., 2013). However, when their characteristics are analysed based on looking at reports en masse, similar to how an analysis of material objects can disclose a lot of their makers and users, they can provide insights into archaeological knowing and its sociomaterial entanglements.

Two Perspectives to Writing Archaeological Reports

Earlier studies of archaeological knowledge production (e.g., Berggren & Gutehall, 2018; Boast & Biehl, 2011; Davidović, 2009; Khazraee & Gasson, 2014; Pruitt, 2011) and how archaeologists inform and get

informed about research practices and decision-making (e.g., Huvila, 2020; Huvila et al., 2021) enumerate techniques—corresponding with those identified in parallel contexts of scholarly and professional work—to help information travel. These includes work protocols, ontologies and workflows (Gilissen & Hollander, 2017; Nuninger et al., 2020; Wilkins, 2020), photographs, narratives, references to methods, tools and methods literature, descriptions of and references to work processes and actors who participated in the work (Huvila et al., 2021), accounts of outcomes and outputs of work, and first-hand participation in doing the work itself (Huvila, 2020). Somewhat roughly, the approaches that are identifiable also in investigation reports, can be divided to two broad categories according to whether they are geared towards being approachable as *ex ante* information for preserving and 'retrieving' an account on what happened, and information that can help in post hoc 'construction' of understanding—or as we chose for this chapter from the palette of earlier introduced terms, *traces* that contain cues about the practices that once were exercised and *ingredients* that direct knowledge-making to new directions.

As the discussion so far suggests, archaeological reports have multiple functions and they can be read both *from* different perspectives and *as* different kinds of things. In the following, through engaging with a set of recent Swedish and French archaeological field reports, we continue by inquiring into two distinct perspectives to their potential function: (1) as traces of how knowing happens in practice, and (2) as ingredients for developing an understanding of knowledge-in-practice during archaeological fieldwork. In somewhat rough terms these two perspectives parallel with corresponding understandings (according to Latour, 1993 and Olivier, 2008 respectively) of reports and archaeological record (i.e., the totality of archaeological evidence, cf. Patrik, 1985) as sociotechnical things and memory objects (cf. Lamy & Plutniak, 2016). As memory objects, they unfold as traces of past courses of action—those of the people of the past and those of investigating archaeologists—whereas as sociotechnical things, they are as much invented as they are discovered (cf. Olivier, 2008) to function as ingredients and propellers in the processes of how knowing happens as a part of archaeological practice. In this respect, in Latour's (1999) terminology they are both 'signs' rather

than 'things'. Bates (2006) places traces or 'trace information' as a part of the 'residue lineage' of information that lives after the 'death' of processes whereas her embedded and recorded forms of information in the 'exomatic lineage' (a concept borrowed from Goonatilake, 1991) remind of ingredients. In a rough sense, traces—as discussed in this chapter—can be understood as elements that directly inform of past practice whereas ingredients function as components in creating an understanding for past activities by providing a basis for imagining or reproducing (parts of) the process. However, neither of the two are only passive accounts or blueprints of past events (cf. Geiger & Ribes, 2011; Van Beveren, 2002). Thinking along the lines of Derrida (1967), there is a rupture between both traces and ingredients and their related pasts, presents and futures. Instead of pointing to or indicating something, both traces and ingredients are used by their creators to explicitly and inadvertently communicate, coordinate and render activities accountable (cf. Avdeenko et al., 2016; Geiger & Ribes, 2011).

In the following two sections, we draw on an iterative close reading of a set of archaeological field reports from Sweden (N = 47) and France (N = 38) published in local grey literature repositories respectively in 2018 and 2020. Rather than aiming to report a comprehensive analysis of the documents, the aim of the close reading of the field reports and their contents is to extract examples of how specific elements within archaeological reports can be read partly as traces of how archaeologists came to know during a particular archaeological investigation and partly as ingredients to construct—or in a sense to invent—an understanding of how knowing happened in practice. The individual reports are referred to in the following using codes starting with S (for Sweden) and F (for France) followed by a sequential number. All quotes have been translated from Swedish and French to English.

Traces in Archaeological Reports

The analysed corpus of texts reports a wide array of different types of investigations around France and Sweden. Representing fairly well typical contemporary archaeological fieldwork, the majority reported

small-scale open-air surveys and excavations conducted ahead of public and private land development, for example, roadworks, construction of pipelines, and renovation of buildings rather than researcher-initiated projects. The datation of the sites ranged from the Stone Age to the contemporary.

In a close reading of the reports, it is possible to distinguish multiple types of information that contain traces of archaeological practices and how things come to be known as a part of them. Making a clear-cut distinction between what can and cannot function as a trace is impossible, much similar to separating individual elements of reports from the whole. However, to illustrate what constitutes a trace and how they work, we will look closer at two recurrent elements in the analysed archaeological reports, namely Find lists, and Plans and section drawings.

Find lists can be found in all reports whenever finds (i.e., material artefacts) were collected during investigation. In some cases, nothing was found and subsequently no finds were retrieved (e.g., S42, S46, F22, F28, F31). The main purpose of a find list is to provide a tabular summary of all finds, where they were found within the investigation site, what is their material (e.g., ceramics, stone, iron, bone, wood), closer designation and function (e.g., container/vessel, a fragment of an adult fibula), and often how much the physical find weighs. At the same time, however, both the finds and what information is recorded in the finds table unfold as traces of what was collected, how they were analysed and conceptualised and which of their characteristics were considered noteworthy. Furthermore, a find list also contains traces of how precisely individual finds were likely to have been measured and weighed: in millimetres, centimetres, grams or kilograms and how many meaningful decimals are indicated in the list (F16, F37 cf. S25). The vocabulary used contains traces of both the observers' specific interests and focus on the investigation and their epistemic frame within which they interpreted the finds.

Plans and section drawings are used in archaeological reports to provide an overview and a visual representation of the horizontal (plans) and vertical (sections) surfaces of the investigation site (example in Fig. 2.1). They function as maps and orient the reader in the site. At the same time, plans and section drawings provide a diagrammatic representation of the major points of interest of the site from the perspective of the

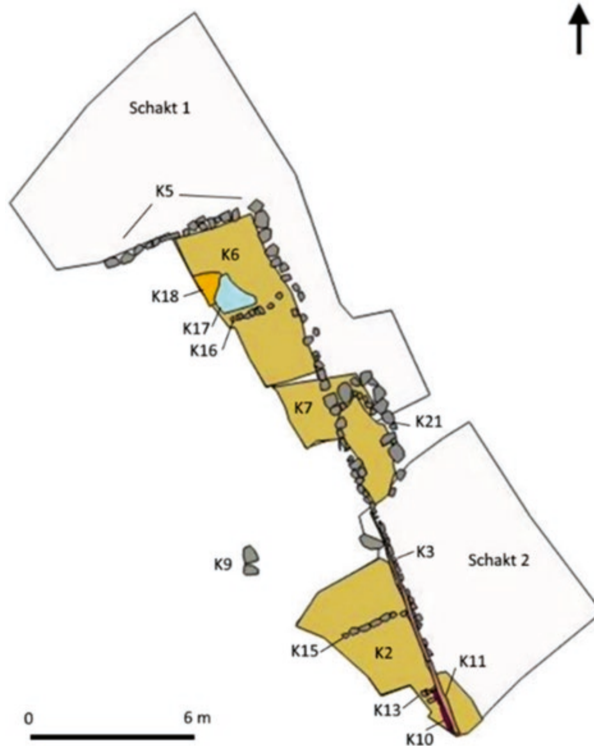

Fig. 2.1 An example of plan drawing on the page 55 of the report S51: Credit: Jönsson, Lars (2018). Arkeologisk förundersökning 2018 GC-väg längs väg 9 mellan Ravlunda och Kivik GÅNG- OCH CYKELVÄG RAÄ Vitaby 141–144 och RAÄ Ravlunda 181, Ravlunda och Vitaby socknar i Simrishamns kommun, Skåne län. Ystad: Österlenarkeologi. Licensed as CC-BY (page 65 of the report)

investigating archaeologist. They are conscious distillations and schematisations. Being intentional simplifications, the aspects, which are documented and how the observed stratum is divided, for instance, to levels, contexts and features are traces of deliberate acts of interpretation. A plan reveals often whether features were measured as points (e.g., S30, F37) or areas (e.g., S25 or S51 in Fig. 2.1) suggesting of the adopted workflow and how the site was conceived in spatial terms. Similarly, the numbering of the documented features can function as an ingredient to construct an understanding of the process of how the stratification of the documented

site opened up for its investigators (e.g., F31, F34, S53; see also Khazraee Afzali, 2014).

The previous examples of how different elements of archaeological reports can be approached as traces provide evidence of how elements of reports can function as a trace of how archaeological knowing happens in the field but also as what constitutes them as memory-objects of past archaeological knowing. While all the traces discussed above were actively produced by report writers, a parallel key aspect of the elements conceived as such in the reports is that they were relatively thin (cf. Geiger & Ribes, 2011) considering the complexity of the processes they describe.

The examples show also how both the presence and absence of information can constitute a trace. Some of the absences and presences are clearer whereas others need to be interpreted with caution and in the context of the complete report and if possible, considering all available documentation material from the investigation. The lack of information and description of particular aspects of the work might suggest that it is a convention or that something else was considered more relevant to document in the specific situation but also that the undocumented considerations and actions were seen as plainly irrelevant in the given situation.

Ingredients in Archaeological Reports

Besides traces, the reports contain elements that can potentially function as ingredients for future knowledge-making on how knowing happened during a reported investigation. Similar to traces, ingredients spread out the reports as a whole and can only partially be traced back to their individual elements. However, to illustrate how and what in the analysed reports can be conceptualised as ingredients, we turn attention to two specific elements, process narratives and action photographs.

Many of the reports contain *narratives* that in a varying level of detail and explicitness (e.g., F28, S42 cf. S11, S53, F38) describe investigation processes. Such descriptions can be sometimes found in separate sections titled, for instance, 'Strategy and methods' (F1) or 'Purpose, aim, methods' (S44) that are used beyond referring to particular types of strategies or methods to accommodate a description of the investigation process. In

other cases, such a narrative can be a part of the description of findings (e.g., S14, also S47). The following extract from S10 (page 12) illustrates the genre:

> *Pre-investigation was conducted through test-, search- and deep excavation using a hydraulic excavator oversaw by an archaeologist. Several archaeological remains were investigated and samples were retrieved.*
>
> *The test excavating was done by digging up a blade-wide search-trench. When archaeologically interesting remains were found, larger areas were excavated to, for example, determine their extent, character and spread. Deep trenches were excavated also when discovered remains were investigated.*
>
> *In total nine different trenches were unearthed with the hydraulic excavator. As a whole, 506 m2 within the area of investigation was excavated. This corresponds to 6.7% of the total area.*
>
> *All finds discovered on the Mesolithic level (A101) were point measured similarly to individual finds found features on upper levels. A excavation unit of one square-metre in the cultural layer (A602) was dry-sieved.*[1]

The purpose of such narratives is to provide a description of how the investigation proceeded and a basis for developing an understanding of the outline of the project as a whole. The analysed descriptions tended to be brief, considering the length and complexity of the work they described, and technical and unembellished rather than reflective. It is perhaps not surprising that reports of failures in following a particular procedure were rare (exceptions e.g., S10, S25). Even if the prosaic and objectivising air of narratives make them to a certain degree reminiscent of traces, they are matter-of-factually to a greater extent constructs rather

[1] Original: 'Förundersökningen genomfördes genom att prov-, sök- och djupschaktning med grävmaskin som följdes av en arkeolog. Ett antal arkeologiska lämningar undersöktes och provtogs.

Provschaktningen genomfördes genom att sökschakt om en skopbredd togs upp. Vid påträffandet av arkeologiskt intressanta lämningar togs större ytor upp bl.a. för att fastslå omfattning, karaktär och utbredning av dessa lämningar. Djupschakt drogs även efter att påträffade lämningar undersökts.

Totalt togs nio olika schakt upp med grävmaskinen. Sammanlagt schaktades 506 m2 upp inom undersökningsområdet, vilket motsvarar 6.7% av undersökningsområdets totala yta.

Alla fynd påträffade på den mesolitiska nivån, (A101) punktinmättes och även enstaka fynd som framkom i anläggningar på den högre nivån. En kvadratmeterstor grävenhet i ett kulturlager (A602) torrsållades.'

than residues of activities. As such, it makes better analytical sense to treat them as (consciously produced) ingredients of future knowledge-making rather than as imprints of earlier actions.

Another element in the report that epitomises the idea of an ingredient are the so-called action photographs or *'action shots'* (Hamilton, 2007) depicting archaeologists at work. Their purpose is to give a sense of the site and the conducted work. The principal relevance of action shots is often framed in relation to public communication (e.g., Mann, 2019), as Schlitz puts it, to record 'team members using equipment to illustrate archaeological methods for lectures and publications' (Schlitz, 2007, p. 506). In action shots reproduced in the analysed material, individuals are not necessarily easily identifiable (e.g., F1, F7, S15 exceptions e.g., S12, S40, F27, F30, F37) and sometimes there is relatively little visible action when individuals are standing or kneeling at the investigation site (e.g., F30, S7). Still as a whole, such photographs can be informative on context and conditions of work, work procedures, tools and who was doing what. As such, even if they can be staged, they provide snapshots of how the work was done in practice and a starting point to (re)construct the process as a whole. Figure 2.2 provides an example of an action shot. While an action shot contains plenty of traces of archaeological work, as a genre of information, the shot itself reminds a narrative in that it is literally an intentionally produced and choreographed (cf. Huvila & Sköld, 2021) snapshot of a specific setting.

While many of the traces discussed in the previous section can be for a good reason described as thin (cf. Geiger & Ribes, 2011) descriptions of highly complex undertakings, the ingredients appear to unfold as even more papery and translucent. A useful ingredient can be difficult to identify as such without considerable contextual knowledge of archaeological work, how it is conventionally documented, and how a documentation is expected to be interpreted. While it is perhaps an exaggeration to suggest that identifying trace elements in a find list does not require expert knowledge, it is probably easier than to say what in a brief narrative or action shot is helpful as an ingredient and how to interpret it. Furthermore, identifying a trace or an ingredient is only the first step in putting them to work. Even if it might sound somewhat paradoxical, in the absence of others, a solitary trace or ingredient can raise more questions than provide answers.

Arendus rapport 2018:2

Arkeologisk undersökning av RAÄ Hamra 11:1 på Hamra St. Sindarve 1:12 samt Hamra s:27

Arkeologisk undersökning
Dnr: 431-1086-2017

Hamra socken
Region Gotland
Gotlands län
2018

Christian Hoffman

Fig. 2.2 An example of an action shot in the cover of the report S5: Credit: Christian Hoffman (2018). Arkeologisk undersökning av RAÄ Hamra 11:1 på Hamra St. Sindarve 1:12 samt Hamra s:27. Arendus rapport 2018:2. Visby: Arendus. Licence CC-BY-4.0

Traces as Ingredients and Ingredients as Traces

Even if narratives and action shots are in many respects illustrative as ingredients, looking back to find lists, plans and section drawings makes plain how even they contain elements that can be used for the same purpose. A find list can be appropriated as a starting point to making inferences of the significance of documented finds, their potential to add to the current archaeological knowledge, and what could be reasonable points of interest for further investigations and scrutiny in the matter. Similarly, also plans and section drawings can be put to work as socio-technical ingredients, to direct knowing in specific directions and effectively obstruct it from proceeding to others even if their principal purpose would be to function as a trace of a particular observation. However, even if there are opportunities to some degree of interchangeability—or interoperability—between traces and ingredients, the previously discussed examples are not symmetrical in theory or practice. A find list and a drawing incorporate from a trace perspective unconscious (or perhaps a half-conscious) residues of doings while as ingredients, a narrative and an action shot are purposefully crafted descriptions.

A closer look at reports shows also that similarly to how the absence of information can be informative as a trace similarly to its presence, the lack of information can also function as an ingredient to appraise (the lack of) its perceived significance. This is not, of course, always the case. For example, the state of conservation of certain artefacts rather than the lack of attention can explain sparse descriptive information similar to whether they are photographed or (not) drawn in a plan. Furthermore, as perhaps especially with action shots, the absence and presence of information can also depend on the availability of time and convenience to produce particular types of ingredients. It is conceivable that photographs are more likely to be taken when something relevant is considered to be happening but also occasionally when nothing critical is going on and the photographer feels that there is time to take a few additional shots. When in hurry, it is understandable that documentation might remain more rudimentary.

Discussion

A close reading of archaeological reports provides a glimpse of how they convey information on not only the results of a specific investigation but also of the investigation process. Even more so, an inquiry into reports provides a fruitful starting point to pursue a better understanding of complementarities, (dis)similarities and contrasts of different breeds of epistemic artefacts and things within—in this chapter, specifically with a starting point on the two introduced in the beginning—traces and ingredients. First, this section discusses what characterises traces and ingredients in relation to each other, followed by an exploration of *how* they complement each other in knowledge-making, *what* they do for knowledge-making, and *when* they do it. When considering what traces and ingredients are, what and when they do whatever they do, it is critical to follow two parallel lines of inquiry into their onto-epistemological becoming. When following traces and ingredients in the entanglements of archaeological knowledge work, it is critical for us as researchers to follow our own engagements with them and how our own epistemic practices construct them as participants of the research we engage in.

Characterising Traces and Ingredients

As epistemic devices, traces and ingredients contribute in distinct ways to knowledge-making, and in case of archaeology and archaeological investigation reports, to making knowledge of how archaeologists worked during the reported investigation. Concerning how traces and ingredients function as they do, we propose four facets that characterise and distinguish them.

Traces and ingredients are overlapping and complementing each other. It was possible to identify elements with distinct affordances to function specifically as traces or ingredients. However, at the same time it was

apparent that their trace'ness and ingredient'ness overlap and flow through and beyond specific elements of reports to an extent that it is reasonable to argue that both reports and their elements can function as traces, ingredients or both. Therefore, rather than being distinctive empirical entities, traces and ingredients surface as analytical categories of informative functions of things. This means that nothing is trace or ingredient by definition but only in relation to *how* they can be appropriated in use for a particular purpose, for example, to inform as a trace how knowing took place or as an ingredient to contribute to knowledge-making on past work practices. The archaeological reports contained a lot of examples of how traces and ingredients overlap. Plan and section drawings used as an example of ingredients did also contain both implicit and explicit traces of work processes, what tools (cf. tools in Geiger & Ribes, 2011) were used and in which order the work proceeded. The lack of very small finds in a finds list could suggest that the investigation was done coarsely, for example, using a shovel and pickaxe rather than a trowel or sieve. Similarly, the narratives of investigation processes provided cues of how to interpret the site. Even if not otherwise indicated, the more careful investigation of the specific parts of the site could signal of its specific significance. For action shots, while their principal purpose is not to provide a meticulous documentation of specific features of the site or investigation, they could provide useful orientation and contextual information as a basis for developing an understanding of how to interpret the reported findings.

Both traces and ingredients inform and coordinate work. In the glimpse into the reports, we focused on how they convey understanding of archaeological investigation processes and in a sense function as 'paradata' (Huvila, 2022) that is, information on processes pertaining to collection, organisation and management of archaeological information. In a broader sense, it is obviously possible to imagine traces and ingredients of not only (of processes of) knowing but also of other things independent of what they are informing about. The major difference between traces and ingredients is in *how* they engage in the agencements of informing and coordination much similarly to how the earlier literature has characterised different types of things that participate in knowing from plastic but still robust enough 'boundary objects' (Star, 1988) and their less

entrenched cousins 'boundary negotiating artefacts' (Lee, 2005) to perspective-giving 'figuring objects' (Pénet, 2015). Engaging a thing as a trace or an ingredient is a decision unfolding in the entanglement of practice elements that can be described from the premises of Oakeshott's (1989) theorising of knowledge as what types of *judgments* are needed to set respectively traces and ingredients in motion to create knowledge. For ingredients these consist of inferences made on the basis of a backwards reading of the outcomes of processes whereas traces require devouring forward to (re)construct how knowing took place in practice.

Traces and ingredients are contextual to particular sets of agencements and genres. Even if this claim cannot be substantiated by analysing only a set of documents from one domain and genre (with elements belonging to a plethora of sub-genres), all the identified traces and ingredients are clearly conditioned by archaeological (information and knowledge) practices and by how particular genres of documents and documentation methods are used in that specific entanglement of entities. This aligns with earlier findings of the significance of tacit knowledge (Davidović, 2009) and social information exchange in archaeological work (e.g., Huvila, 2014; Morgan & Wright, 2018), and with the observations of the particularities of archaeological social and literary genres (Huvila, 2019). Find tables, action shots, process narratives, plans and section drawings have parallels in other domains (in other field sciences, cf. e.g., Law & Lynch, 1988; Kohler, 2002; Canfield et al., 2011; Rytter et al., 2020, but also elsewhere) but the particulars how they function as traces and ingredients is specific to the specific agencement of archaeology (e.g., what is being photographed, how work is described). This applies also to the projected finality of the document. Further on the basis of earlier studies of actively updated databases and information systems (e.g., Börjesson et al., 2022; Geiger, 2016), both how traces and ingredients are intended to be used and what affordances they have for use as traces and ingredients depend on whether they are a part of a living work-in-progress document or a final 'product'. This suggests that the coordinative function of the reports function on the agencement level (i.e., national/regional archaeological work) rather than on the level of individual entities (i.e., individual report or its elements).

Using both traces and ingredients requires participation in the onto-epistemological agencement. Unsurprisingly, considering their domain-specificity, the examples from archaeological report genre confirm that traces (cf. e.g., Geiger, 2016) and ingredients alike can easily be illegible for someone who has no insider knowledge of the community where they originate. Moreover, the traces (as for Geiger & Ribes, 2011) or ingredients that are readily recognisable might not be the most interesting or informative ones as the close reading of find lists and diagrams suggest. A part of the necessary insider knowledge is cognisance of how information genres in the particular domain have developed (cf. Geiger, 2016) and what are the conventions that guide the description of activities. A key difference between ingredients and traces is that ingredients can be difficult to recognise as ingredients. In contrast, if traces are provided (cf. the presence and absence of narratives—how they are occasionally masked, see Ullah, 2015; Huvila, 2020) they are probably somewhat easier to recognise even if they can be equally difficult to understand and engage with in (re)constructing past activities.

Overall, considering how traces and ingredients function within and towards the communities where they operate, the glimpse at archaeological reports suggests that while they participate in knowledge-making, they both form distinct mediating communities as particular knowledge practices (cf. Geiger, 2016; Gensollen, 2003). Besides being mediated through hands-on engagement with the material remains of the human past (Berggren & Hodder, 2003) and discussions on the edge of the trench, archaeology is mediated also through drawing (Morgan & Wright, 2018) and writing (Lucas, 2019), and photographing (Shanks & Svabo, 2016). More specifically, as we are inclined to suggest, the mediation comes about through agencement comprising traces and ingredients that underpin the community—even such a community as archaeology with an outspoken ideal is to produce explicit documentation and descriptions. Rather than being something intrinsic to archaeology or any other domain, we gravitate towards proposing that knowing, the making of mediation and consequently that of making the community happen is a learned literacy (cf. Geiger, 2016; Huvila, 2020) and as such a critical part of being able to participate in a knowledge practice. It is a practical

competence with an onto-epistemic dimension that eventually shortens the 'epistemic distance' (Huvila, 2020) between an individual and the 'community' (or agencement) of archaeological report writing.

How: Trace and Ingredient-Making Reduces and Contributes to the Elusiveness of Knowing

Reports are in many respects useful documents of archaeological work but it would hardly be justified to claim that a report provides a compendium of ingredients to redo an investigation-in-practice or a complete set of traces of what was done. A part of the problem is quite obviously, paraphrasing Burns' (2021) fourth thesis on digital documents, that archaeology is an example of a domain that demands a lot from documentation in general and from reports in particular far beyond what is achievable in practice. Report writers can impossibly know all current and future needs others might have on the investigation they document. At the same time, Sebbah (2015) has suggested of digital information technologies that they permit to trace too much to a degree that nullifies the trace. We find it believable that a particular agencement of epistemic things, not only digital ones but also, for example, a report can both fail to encompass enough traces and ingredients, and to provide means for incorporating traces and ingredients to such an endless extent that risks to render them all ineffective. From the perspective of conceptualising reports as consisting of and functioning as traces and ingredients, and report-writing as making of traces and ingredients, the impossibility lies in laying out an intact fabric of either of the two alone.

However, a parallel problem to the impossibility to anticipate the unknown is what Burns describes as the inadequacy of the metaphor—in this case—of the archaeological report as a comprehensive set of traces that could function as an exhaustive account of an investigation-as-practice or a list of ingredients for redoing it. This is more than apparent in how the traces and ingredients discussed earlier in the chapter are complementary but by no means exhaustive. A parallel colloquial observation of archaeology to its concern for the material world is its focus on

collecting, curating and documentation beyond many other scholarly and scientific disciplines. Still, as for instance, Davidović (2009) underlines, much of archaeological knowing is tacit and passed on from one archaeologist to another in practice. Archaeological reporting provides an illustrative example of how the ideal of a complete account collides with a reality of incomplete documentation. In this sense, a report could better be described, as Mickel (2013) suggests, in terms of a montage—and rather than a montage of comprehensive descriptions, better as a montage of traces and ingredients that require, as Wylie (2017) proposes, an intricate intellectual scaffolding to become comprehensible. In posthumanist terms, the montage unfolds as an agencement where the scaffolding is a part of its fabric rather than an external framework. Continuing with Burns (2021), while exaggerated pessimism with the capability of scientific and scholarly documentation to contribute to knowledge-making is unnecessary, a closer look at documentation like archaeological reports underlines the fact that every single trace or ingredient required by someone cannot be inscribed, archived or otherwise embedded in or turned to an epistemic artefact. As a fair proportion of knowledge must be taught and passed from one individual to another (Burns, 2021) rather than mediated through manipulation of information in artefactual form, it is apparent that alone and detached from the agencement, any individual things—including traces and ingredients—make knowing both easier and more difficult and reduce and contribute to how elusive it is.

What: Stability and Volatility of Traces and Ingredients

A parallel question to how traces and ingredients complement each other in knowledge-making, is what the agencement of traces and (or) ingredients does for knowing. Approached or 'reified' (Dupré & Leonelli, 2022) as a trace, both a complete report and its individual elements align towards producing a (relatively) stable record of a particular archaeological site, results of a specific investigation on that site and of the investigation process itself. This is evinced in the archaeological reports by how

they, despite their shortcomings, usually provide an adequate set of traces to understand how a specific investigation proceeded (e.g., Gustafsson & Magnusson Staaf, 2001; Huvila et al., 2022). Elsewhere, for example, the usefulness of (historical) photographs as evidence of past activities (as e.g. in Nyssen et al., 2010) of otherwise undocumented restoration of archaeological remains suggests of the same.

In contrast, when approached as an ingredient, a report turns to being much more volatile. Rather than being a stable record, it unfolds in the agencement of practice as an empathetically relational artefact or entity. Instead of analogising a narrative of a work process as an ideal complete account of what really was done, an ingredient is better described as a starting point for developing an understanding of what happened when it is enmeshed together with its reader's personal experiences and prior knowledge of archaeological work. One prominent conceptualisation used in the earlier literature (Huvila, 2011) to characterise archaeological reports is Star's (1988, also Star & Griesemer, 1989) notion of boundary object. This emphasises their plasticity and the manner in which they are present and operate in multiple practices according to their local needs but still maintain a common identity (cf. Star & Griesemer, 1989). Like boundary objects, ingredients are recognisable rather than stable. However, an ingredient is also a starting point for exploration and literally a building block rather than a fixed foundation or cornerstone.

The paradox of thinking about reports and their elements as traces and ingredients is that *producing* a trace and ingredient have—if not contradictory, at least different—implications to what is produced. Similarly, *using* them as traces or ingredients have similarly distinct implications to how they open up to be acted with. As a result, both conscious and unconscious conceptualisation of things and their elements in terms of traces can easily 'mask' aspects of them that could serve as ingredients and vice versa. Ullah (2015) describes in a study of archaeological legacy documentation how it often contains cues to what operations were performed on it but how such evidence gets easily 'masked' by later operations. Rounding of coordinate values leaves a trace when the figures are given on a certain level of accuracy; but when they are transformed into a new coordinate system, this clue disappears. The same applies to reports if information is extracted from them, used to produce new

information and reported elsewhere. In a more foundational sense, comparable loss of information is immanent already when a report or a part of it is considered as a stable trace of a measurement rather than as a deliberate starting point and ingredient for further exploration.

Even if it is implausible to suggest that unintentional masking could be completely avoided in the agencement of archaeological knowledge-making, when a report is written, approaching them and other comparable forms of documentation simultaneously as a trace *and* potential ingredient might help to circumvent some of these issues. It seems reasonable to suggest that this applies especially to long-term knowledge-making needs that, as Karasti et al. (2006) aptly observe, become easily marginalised in the fervour of trying to meet short-term goals.

When: Knowing Happening in Practice

A natural follow-up question to proposing on the whatness of archaeological reports that it can be fruitful to treat their contents—and possibly in some sense, the reports as a whole—as both traces and ingredients is to ask following Engeström's (1990) lead *when* a report and its specific elements are traces and when they are ingredients. In a study of glass and plastic containers in a biology laboratory Lamy and Plutniak (2016) argue against treating artefacts as actants or bestowing agency to only their human users but instead drawing on the notion of cultural technologies (Lemonnier, 2012). From this standpoint, while the form and functions of an artefact form the basic repertoire of actions how it can entangle itself in a practice, within these limits the realisation of the flow of agency in the agencement (i.e., who or what has agency, when and where, and how the practice unfolds) dictates what happens in practice. The same can be argued about traces and ingredients in the analysed archaeological reports. The report genre, elements (incl. text, photographs, maps, plans, tables) included in the document and its composition form the basis of how it can be appropriated in use. However, the treating of information within as traces or ingredients or the report object as a stable record, boundary object or something else, depends on how agency circulates between different agents, their doings and how their

decisions affect the unfolding of the practice. What this means (in practice) is that archaeological knowing in relation to and together with reports happens literally *in* practice through utilising them in terms of traces and ingredients in knowing and making things knowable. A functional archaeological report—and in more generic terms an epistemic artefact—that unfolds as a fabric or agencement of traces and ingredients happens in its making (reporting) and setting the report (artefact) in motion rather than being a specific thing that can be produced according to a fixed set of guidelines.

With an archaeological report as an example of an artefact that both aims to inform of earlier practices and provide a basis for contemporary and future knowledge-making, it becomes apparent that the two functions and the exact moment when they kick in are impossible to separate from each other. As researchers, we can do analytical distinctions that facilitate the understanding of the onto-epistemology of archaeological knowledge work but as significant it is to acknowledge how the different epistemic artefacts unfold only through its agencement, the same applies also to our own analytical distinctions. Much similarly to how posthumanist theorising (Gherardi, 2021) and evidence-based studies of craftwork (cf. Baker, 2017; Scrivener & Chapman, 2004) alike suggest that artefacts and their making are inseparable, a report as a fabric of traces of previous activities and ingredients to inform future doings. The frustration of the shortcoming of reports and report-writing and the level of insights in the past archaeological work they provide and their simultaneous surprising adequacy as a basis for complex inferences could suggest, however, that this fabric is not necessarily smooth and flawless. A perfect trace is not necessarily an equally good ingredient and a perfect ingredient for knowledge-making can be a bad trace of what happened or was done previously—but also that ingredients can still be taken over as traces and vice versa even if they would only do a fairly good job in their secondary role. Accepting their differences both *ex ante* and post hoc could, if not remit, at least help to understand why some epistemic things seem to have shortcomings as traces (cf. e.g., Sebbah, 2015), ingredients or something else. Moreover, even if a fabric of traces or ingredients alone would not be intact, placing them over one another can be expected to make some of the holes disappear.

Conclusions

This chapter has inquired into the complementarities, (dis)similarities and contrasts of two specific types of 'things'—traces and ingredients of how knowing happens in archaeology—and how they work together and against each other in conveying understanding of past knowledge-making. Our work points to that traces and ingredients are complementary and overlapping. They both engage in informing and coordinating work, are contextual to domains and genres, and require contextual insider knowledge to be understood. They are also distinct in how they are linked to the broader agencements of knowing. If the agencements break, individual traces and ingredients can also make knowing more difficult. While a trace is oriented towards being a stable record and an ingredient an adaptable piece in the machinery of knowing, no artefact is essentially a trace or ingredient for everyone. They are produced and taken into use as such in a particular agencement. In the particular agencement, their making and use as traces or ingredients bestow on them with certain capabilities to act accordingly, and hampers, yet without preventing, their usefulness for other uses.

Apart from helping to understand the epistemic opportunities and limitations inherent to artefacts devised to act in particular ways—here with a particular attention to traces of past actions and ingredients of future knowing—in this chapter we have elucidated how the disposition of things is only a suggestion. Many traces can act as ingredients and vice versa albeit with certain limitations important to acknowledge. Experiencing that a document or tool is failing in a particular pursuit for knowing—for example, an archaeological report in helping to know how an excavation was conducted—can be traced back to its characteristics as an epistemic artefact and its prospects to act within a particular agencement of knowing, for example, concerning past archaeological activities. Instead of assuming that an artefact like an archaeological report is a monolithic epistemic thing, recognising its epistemic plurality can help to evade some of the practical and theoretical limitations of seeing it merely as a trace or ingredient, to use it according to their capabilities,

and eventually develop new artefacts with specific, desirable epistemic affordances and constraints that better tie in the entanglements of how archaeological knowing unfolds.

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