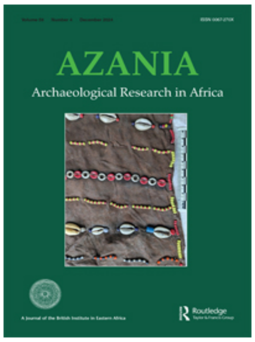

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Making connections: ostrich eggshell beads as indicators of precolonial societal interaction in southeastern southern Africa

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ABSTRACT

Ostriches are peculiar birds and their strangeness has been recognised by southern African hunter-gatherers through multiple symbolic associations. Such qualities are likely to have been enhanced where people had access to beads made from their eggshell but did not have direct knowledge of the birds themselves. Southeastern southern Africa, encompassing the Maloti-Drakensberg Mountains, the eastern half of the Eastern Cape Province and much of KwaZulu-Natal is one such area. We review the unusual attributes and associations of ostriches and their eggshell before briefly summarising previous work that has used strontium isotope analysis to investigate past bead exchange networks in this region. Because bead size can be controlled and patently varies through time and space, we then employ it as another potential indicator of the existence and spatial extent of past social networks. Having critically considered previous efforts in this field, we report on our work to build the largest sample of such data yet obtained in southern Africa and compare our preliminary results with other signals of interaction between precolonial hunter-gatherer and (where applicable) agropastoralist communities.

RÉSUMÉ

Les autruches sont des oiseaux particuliers et leur étrangeté a été reconnue par les chasseurs-cueilleurs d'Afrique australe à travers de multiples associations symboliques. Ces qualités ont probablement été renforcées là où les gens avaient accès à des perles fabriquées à partir de leur coquille d'œuf mais n'avaient pas de connaissance directe des oiseaux ils-mêmes. Le sud-est de l'Afrique australe, englobant les montagnes Maloti-Drakensberg, la

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moitié orientale de la province du Cap oriental et une grande partie du KwaZulu-Natal, est l'une de ces régions. Nous passons en revue les attributs et associations inhabituels des autruches et de leur coquille d'œuf avant de résumer brièvement les travaux antérieurs qui ont utilisé l'analyse des isotopes du strontium pour étudier les anciens réseaux d'échange de perles dans cette région. Puisque la taille des perles peut être contrôlée et varie manifestement dans le temps et dans l'espace, nous l'utilisons ensuite comme un autre indicateur potentiel de l'existence et de l'étendue spatiale des réseaux sociaux passés. Après avoir examiné de manière critique les efforts antérieurs dans ce domaine, nous rendons compte de nos travaux visant à constituer le plus grand échantillon de données de ce type jamais obtenu en Afrique australe et comparons nos résultats préliminaires avec d'autres signaux d'interaction entre les chasseurs-cueilleurs précoloniaux et (le cas échéant) les communautés agropastorales.

Introduction

Ostrich eggshell beads are one of the commonest forms of jewellery found in precolonial southern Africa and have a likely time depth within the region of >50,000 years (Dewar and Stewart 2017). Although not as old as shell ornaments made from marine and estuarine molluscs, their initiation early in Marine Isotope Stage 3 (57–25 kya) appears to coincide with the re-establishment of archaeologically visible populations in the southern African interior (Mitchell 2008). Made from what was, across most of southern Africa, a much more ubiquitous raw material and fashionable into highly standardised, durable ornaments at relatively low cost compared to mollusc shells, they may have been innovated and adopted by hunter-gatherers moving into more water-stressed, uncertain environments characterised by repeated, rapid climatic swings (Stewart *et al.* 2020). Whether worn as jewellery or sewn onto skin bags and items of clothing (Hitchcock 2012), their exchange could have established and maintained social safety nets among such populations, just as it has done in some recent Kalahari Bushman societies (Wiessner 1977).

Bead size can be controlled with considerable accuracy and bead-making is an activity in which people can (and often do; e.g. Wingfield 2003) engage communally, with knowledge of how to produce beads transmitted within such groups. Differences in bead measurements may therefore point to the presence of distinct communities of practice exhibiting preferences for beads of different size. Ethnographic evidence supports these points in the twentieth-century Kalahari (Silberbauer 1981; Tapela 2001; Wingfield 2003, 2009), although Wilmsen (2015: 96) cautions that in his experience diameter relates principally to the bead's intended purpose, not the identities of those making it or those to whom it may later be given. Nevertheless, archaeologists have frequently interpreted differences in bead diameter as expressions of ethnic affiliation, distinguishing hunter-gatherer groups from herders (e.g. Jacobson 1987; Smith *et al.* 1991). Most such studies have been undertaken on a geographically restricted basis, but more recently they have encompassed comparisons between eastern and southern Africa (Miller and Sawchuk 2019), as well as claims that ostrich eggshell bead making as a whole was introduced to the latter from the former in the late Pleistocene, establishing connections between the two regions that persisted for several millennia before being disrupted by environmental change (Miller and Wang 2021).

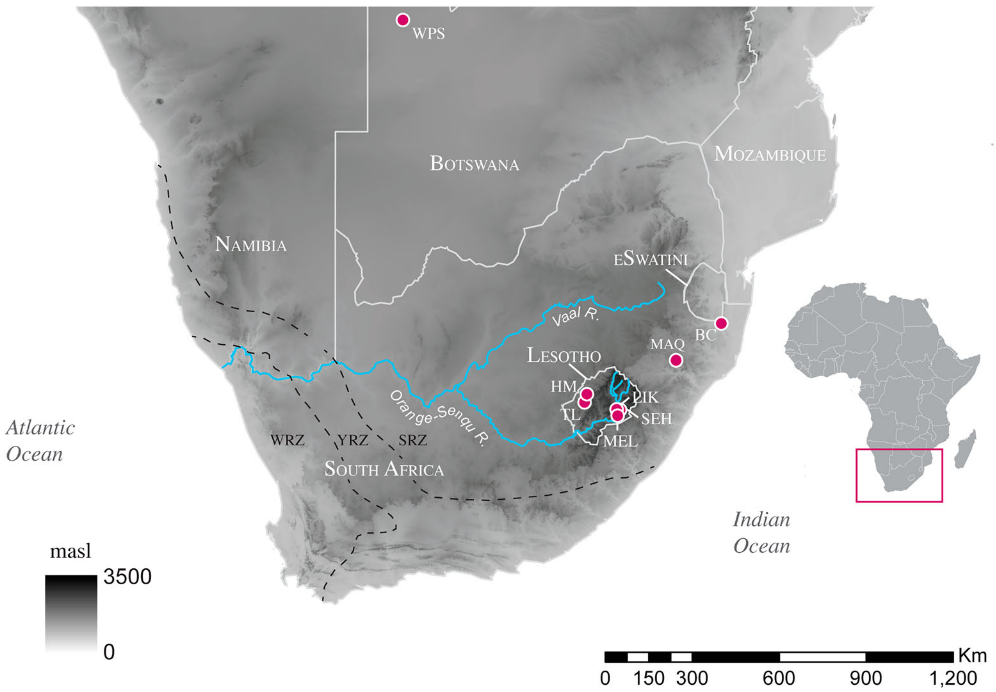

Figure 1. Southern Africa showing the main archaeological sites mentioned in the text. Site names are abbreviated thus: BC Border Cave; HM Ha Makotoko; LIK Likoaeng; MAQ Maqonqo; MEL Melikane; SEH Sehonghong; TL Tloutle; WPS White Paintings Shelter. The boundaries of the region's rainfall zones are also indicated: SRZ summer rainfall zone; YRZ year-round rainfall zone; WRZ winter rainfall zone.

In this paper we first discuss additional reasons why people may have valued ostrich eggshell beads, drawing on ethnographic evidence that identifies them, the eggshell from which they are made and the animals from which both derive as sources of supernatural potency. We then turn to Miller and Wang's (2021) paper and identify important limitations in it that need to be addressed if ostrich eggshell bead metrics are to be used meaningfully as a potential signal of past alliance networks (*sensu* Mazel 1989). Having done this, we explain why southeastern southern Africa (Figure 1) is particularly well-suited to exploring this topic further and summarise our previous work with strontium isotope analysis there to gain insights into how past hunter-gatherers moved ostrich eggshell beads across the landscape. Finally, we set out how new, empirically robust data on ostrich eggshell bead size within this region may relate to such evidence and other signals of interaction.

The peculiarity of ostriches and the power of ostrich eggshell beads

Ostriches (*Struthio camelus*) are peculiar birds: bigger by far than any other, but unable to fly with the result that they can only move bipedally, not unlike people; swift as well as strong (with a top speed of 90 km per hour, second on the African savanna only to a cheetah, and a kick almost three times that of an élite-level boxer, ~141 kg cm^{-2}); and producing eggs so large and robust that, unlike those of most other ratites

(Langley 2018), they can be successfully turned into containers and used as the raw material for jewellery, especially beads. The ethnography of Bushman peoples in southern Africa recognises these peculiarities by attributing to ostriches roles as powerful beings that, depending on the group concerned, variously created people (Valiente Noailles 1988: 218), provided them with knowledge of fire (and thus, metaphorically, of sex; Valiente Noailles 1988: 134–136; Schmidt 1995: 158; Guenther 1999: 152) or once ruled over all the other animals (Eastwood and Eastwood 2006: 108). The association of ostriches with ideas of rebirth and resurrection among yet another Bushman group, the culturally now extinct /Xam of South Africa's Northern Cape Province, further implies an equation with the ability of shamans to move between this world and the world of the spirits given that the latter 'die' on entering trance only to return to everyday life (Bleek and Lloyd 1911: 139; Katz 1982: 115–116). Outside our own research area, these connections are neatly illustrated in engravings from the Namibian rock art complex at /Ui-//aes (previously known as Twyfelfontein) that show a line of four ostriches moving in file like dancers during a healing dance set above others represented — with wings angled downward and without legs — as if experiencing the sensations of weightlessness, physical exertion and eventual collapse that mark trance itself (Kinahan 2020: 120–121).

We have argued elsewhere (Mitchell and Stewart 2024) that these multiple symbolic associations fed directly into how ostrich body parts or products were understood, drawing on a much broader linkage between raw materials and the objects made from them. For the /Xam, for instance, *!nwa* meant both 'arrow' and 'reed', the material from which arrow shafts were made. /Xam myths also detail how quivers could revert to being springbok and how karosses — skin cloaks — likewise retained the supernatural potency of the animals that supplied the hides used to make them (Lewis-Williams and Pearce 2004: 120). The widely attested preference for using ostrich leg bones to make arrowpoints and the linkshafts connecting them to their shafts (Barrow 1801: 149; Schapera 1927: 114; Burchell 1953: 142, 149; Sparrman 1975: 196) likely speaks to the same: material choice here is not just about the bones' thickness and structure, but also about their ability to confer the ostrich's strength, stamina and speed of the arrows of which they form part.

Ostrich eggshell beads and the ostrich eggs from which they are made are, we suggest, another instance of the same. For the Ju/hoãnsi (!Kung) of the northwestern Kalahari, for instance, beads were invented by the mythical Gemsbok People at the beginning of all things (Marshall 1999: 246) and are now indicators of humanness and specifically of being Bushmen. They are also a means by which those participating in healing dances make themselves attractive to the spirits with whom they seek to communicate when in altered states of consciousness (Dowson 1989). More specifically, ostrich eggshell beads are widely held to possess healing properties (Low 2009, 2011), although the ostrich potency that inheres in them must be handled with caution: when women give birth for the first time or children become sick, for instance, their ostrich eggshell beadwork ornaments are removed (Marshall 1999: 119, 209). Meanwhile, ostrich eggs must be disposed of with respect, young hunters and pubescent girls are strictly forbidden from drinking from ostrich eggshell containers and the eggs themselves are avoided until people 'are old enough to have had five children', a prohibition that for young people also extends to the bird's meat (Marshall 1999: 105, 152, 192). Descriptions provided by some shamans of what they observe when in trance include references to threads of ostrich eggshell beads linking heaven and earth, as well as others to God's ostrich egg (*!Xu dsuu-n!o*) being the sources of the healing songs and dances that shamans seek (Keeney 2003, 2015). In another trance-related association, fragments of ostrich eggshell are placed inside moth cocoons to create the rattles that dancers tie around their ankles when participating in healing dances (Katz 1982).

Ostriches, ostrich eggs and ostrich eggshell beads are thus part of a dense constellation of ideas that find particular salience at times of crisis and transition, whether when worn by adult women celebrating a girl's initiation, removed at childbirth or the illness of children, avoided when vulnerably young or understood as a connection between people and the divine. Following the insights of Mary Helms (1988) into the cosmological importance of the exotic and esoteric and of the opportunities for people, especially travellers, to use their knowledge of foreign places and their products as ways of bolstering or legitimising power, the symbolic and supernatural associations of ostriches and ostrich eggshell beads may have been particularly intense in places where ostriches themselves did not exist. In such places, notably much of the southeastern corner of southern Africa, the true size and nature of the birds from which ostrich feathers, eggshell and bones came may have been largely unknown, subjects of rumour and liable to exaggeration and invention. As such, the desirability of wearing or otherwise using items made from them may have been all the greater.

Ostrich eggshell beads and exchange

One of the best-known examples of gift exchange in the anthropological literature concerns the *hxaro* networks maintained by the Ju/hoãnsi of the Kalahari. As described by Wiessner (1977, 1982), *hxaro* is a system of delayed, reciprocal gift-exchange excluding food that is undertaken between consanguineous and (via spouses) close affinal kin. Individuals have between 10 and 16 *hxaro* partners and are most active in these networks during their reproductive years, dropping their partnerships or transferring them to their children as they age. *Hxaro* networks readily extend over distances of ≥100 km with gift-making and gift-giving emphasised at times of the year when people aggregate together in larger groups. *Hxaro* is also intensified when parents seek spouses for their children, producing a close overlap between the spatial geometry of Ju/hoãn exchange and marriage partners (Mazel 1989), but its primary significance lies in creating social ties through which information about people and resources is transmitted and by which people can access food and water when times are hard. *Hxaro* partnerships thus tend to concentrate in areas with the richest and most complementary resources to one's home area (Wiessner 1982). The objects exchanged through them evoke memories of the social relationships encoded in the transactions in which they have previously been involved and the networks through which they have passed (Wingfield 2009).

These observations have been crucial in allowing archaeologists to deploy *hxaro* to help identify past aggregation and dispersal phase camps and alliance networks, explain temporal patterning in the manufacture of potential gift-exchange items on the assumption that this was intensified in environmentally adverse conditions, reassess conventional understandings of jewellery-rich burials and ascertain when social relations like those attested ethnographically among Bushman societies first appeared (Hall and Binneman 1987; Wadley 1987, 1989; Mazel 1989; Deacon 1990). The veracity of such claims is not at issue here, although it is important to recognise that each of these arguments has been contested, that *hxaro* does not exhaust Ju/hoãn exchange practices and that formalised, reciprocal gift-exchange of this kind is not universal among Bushman societies (see Mitchell 2003; Wilmsen 2015 for wider discussion of these points). What is important in the context of this paper is the fact that ostrich eggshell beads are — along with arrows — the items that Ju/hoãnsi prefer to exchange via *hxaro*. Indeed, the very word '*hxaro*' means both 'ostrich eggshell beadwork' and the exchange system through which that beadwork moves (Wiessner 1977).

Measuring interaction using ostrich eggshell bead metrics

With these ethnographic observations in mind, archaeologists have understandably seized upon ostrich eggshell beads as potential indicators of past exchange systems. One way in which they have done this is to focus on the size of the beads found. Reasoning here is simple: bead size can, to a considerable degree, be controlled by the manufacturer and may thus reflect social norms that are shared between communities of beadmakers. Moreover, bead size patently varies between archaeologically assemblages. The best-known example of such variation concerns the argument that larger beads occur within the last 2000 years or so and are associated with herders, rather than with hunter-gatherers. Initially proposed by Jacobson (1987) and subsequently employed by Smith *et al.* (1991) in an attempt to discriminate between herder and forager sites on South Africa's Vredenburg Peninsula, this claim is reinforced by a much larger study of beads from across the western third of southern Africa by Miller and Sawchuk (2019).

More recently, Miller and Wang (2021) have argued that variation in the mean diameter and mean aperture size of ostrich eggshell beads implies that their manufacture spread from East Africa to southern Africa during Marine Isotope Stage 3 (~57–29 kya), with continuing interaction between the two regions signalled by the presence of beads of near-identical size down to ~33 kya. A combination of aridity across much of eastern Africa and flooding of the Zambezi River is then argued to have interrupted these contacts, resulting in long-term regional divergence in bead-making traditions: beads in southern Africa became markedly smaller than their East African counterparts, until incoming herders introduced larger beads to southern Africa around 2000 years ago (Miller and Sawchuk 2019). Having drawn attention to this topic more than a quarter of a century ago (Mitchell 1997; Mitchell *et al.* 1998), we applaud this interest in using the metric parameters of ostrich eggshell beads as a potential measure of exploring interaction between populations. However, to do this successfully requires careful attention to both sample taphonomy and sample size, as well as a recognition that we lack any *a priori* means of determining which measurements may indicate interaction and what scale of difference between measurements might signal the contrary. We explore these issues here in some detail as they relate to Miller and Wang's (2021) study. That done, we outline our own ongoing research into past interaction networks in southeastern southern Africa using ostrich eggshell bead metrics and other data.

The first caveat that needs to be expressed in relation to Miller and Wang's (2021) analysis concerns how beads are found. Archaeological recovery procedures are far from standardised and the fineness of the sieves used in an excavation may vary considerably, with many (typically older) excavations using meshes as coarse as 5 mm, whereas most contemporary projects employ ones of 1–2 mm. Such differences may seem small, but when recovering objects as tiny as ostrich eggshell beads they carry profound consequences (Yates 1995). Consider, for example, the site of Sehonghong in highland Lesotho. Here, Carter (1978: Table 12) recovered 43 beads compared to the 529 produced by later excavations (Plug and Mitchell 2008: Table 15), a twelve-fold increase from trenches of broadly the same volume covering precisely the same late Quaternary sequence.[1] Preservation conditions do not explain this and spatial variation is highly implausible since the two excavations were just 2 m apart. Instead, the reason almost certainly lies in the fact that Carter used a 5.0 mm mesh compared to the 3.0 mm (for the late Holocene DC layer) and 1.5 mm (for all underlying layers) sieves employed in 1992 (Mitchell 1995, 1996a, 1996b). Because the mean size of beads at Sehonghong varies between 3.73 ± 0.58 and 5.17 ± 0.84 mm depending on layer (Table 1) and since a 5.0 mm mesh has a diagonal length of 7.1 mm, most of the beads from Carter's trench very likely went straight through his sieve, never to be recovered. Identifying and taking account of variation in sieving practices is thus crucial whenever bead measurements are compared. This is something that Miller and Wang (2021) do not consider. However, the sources they cite suggests that such differences are unlikely to be trivial (Table 2). More specifically, because the vast majority of Miller and Wang's (2021) pre-33 kya southern African sample comes from Border Cave, at which Beaumont (1978) employed a 3.0 mm mesh, it is quite possible that small beads may have been lost during excavation; Yates and Smith (1993: 98) note that beads with diameters of <4.5 mm can readily pass through a sieve of such size.

Wilmsen (2015) raises two further points of relevance. First, both the external diameter of ostrich eggshell beads and the size of their internal apertures are likely to be sensitive to the pH of the sediments in which they are deposited, with acidic conditions encouraging decalcification of the eggshell and thus a reduction in size (Wilmsen 2015: 95). However, sediment pH is rarely reported in the archaeological literature, making it impossible to ascertain its relevance for the sites discussed by Miller and Wang (2021). Their variable geologies (and thus, we presume, pedologies) would nevertheless suggest that it may not be irrelevant. Easier to appreciate is the likelihood of inter-observer error when individual archaeologists measure ostrich eggshell beads. As Wilmsen (2015: 99) notes, no attempts have yet been made to measure the replicability of bead measurements between analysts, but it seems plausible that a degree of variation may exist and should be taken into account.

Putting issues of sample taphonomy to one side, it is also important to consider sample size. Miller and Wang (2021) identify 14 beads from across southern Africa that predate 33 kya. Of these, 12 come from a single site, Border Cave. However, two

Table 1. Variation through time in the mean size of ostrich eggshell beads from Sehonghong, Lesotho (after Mitchell 1995, 1996a, 1996b).

Layer(s)	Calibrated age (kya)	Number of beads	External diameter (mm)	Internal aperture (mm)
DC	1.1–1.0	140	5.17 ± 0.84	2.58 ± 0.49
GAP	1.6–1.3	28	4.84 ± 0.12	2.23 ± 0.66
GWA	6.7	104	3.73 ± 0.58	1.57 ± 0.33
ALP	8.0–7.8	174	3.93 ± 0.58	1.59 ± 0.33
SA	11.0–10.4	40	4.19 ± 0.67	1.52 ± 0.31
BARF, RF and RBL-CLBRF	15.0–12.9	10	4.80 ± 0.66	Not recorded

Table 2. Sieve mesh sizes employed in recovery of ostrich eggshell beads analysed by Miller and Wang (2021).

Site (after Miller and Wang 2021)	Sieve mesh size employed (mm) after sources cited by Miller and Wang (2021)
East Africa	
1 Kakapel Rockshelter	?
2 Enkapune ya Muto	5.0
3 Mumba Rockshelter	2.0
4 Panga ya Saidi	?
5 Daumboy 3 Rockshelter	2.0
6 Kisese II Rockshelter	?
7 Mlambalasi Rockshelter	1.0
8 Magubike Rockshelter	?
Southern Africa	
9 White Paintings Shelter	5.0–4.0
10 Geduld	?
11 Lower Numas Cave	?
12 Lower Orabes Shelter	?
13 Leopard Cave	2.0
14 Eros	?
15 Wortel	?
16 Bushman Rock Shelter	1.0 and 3.0
17 Border Cave	3.0
18 Apollo 11 Cave	5.0
19 Wonderwerk	1.0
20 Dikbosch 1 Shelter	~3.0 (1/8″)
21 Sehonghong	1.5
22 SK2001.026	1.5
23 Rooiwal Hollow/Midden	1.5
24 Varsche Rivier 003	1.5
25 Paternoster	3.0
26 Grassridge Shelter	1.5
27 Witklip	3.0
28 Kasteelberg A + B	3.0
29 Geelbek Dunes	1.0
30 Voëlvlei	1.0
31 Nelson Bay Cave	~3.0 (1/8″)

(from squares R19 and R20) are, in fact, preforms, i.e. unfinished beads that lack polish or smoothing around the outer rim (d'Errico *et al.* 2012: SI Table 3). According to Miller and Wang's (2021: SI: 23) own criteria, these beads should therefore have been excluded from their analysis. So, too, we suggest should the single bead (one of two beads plus a further three preforms) they cite from the 170–200 cm levels at White Paintings Shelter, Botswana (Robbins *et al.* 2000). This is because although one of the preforms is directly dated to 26,460 ± 300 BP (31,106–30,131 cal. BP; AA-31279) (Robbins 1999), the

Table 3. Ostrich eggshell beads in southern Africa associated with dates of 33–19 kya.

Site	Date (kya)	Number of beads	References
White Paintings Shelter	39–31	6	Robbins *et al.* (2000) (cf. Kokis *et al.* 1998; Staurset and Coulson 2014)
Sehonghong	33.7–31.9	1	Stewart *et al.* (2020)
Reception Shelter	26	2	Orton *et al.* (2011)
Sehonghong	24.3–23.1	2	Plug and Mitchell (2008)
Nelson Bay Cave	23.5–21.0	1	Deacon (1984); Loftus *et al.* (2016)
Spitzkloof A	23	4	Dewar and Stewart (2017)
Nelson Bay Cave	21.9–14.5	8	Deacon (1984); Loftus *et al.* (2016)

sediments at this site have undergone considerable post-depositional disturbance (Kokis *et al.* 1998; Staurset and Coulson 2014). This leaves a sample of just 11 beads scattered across at least 10,000 years and more than 2.5 million km^2, almost all of which come from just one site — Border Cave — where they show a 'wide range of diameters' (4.3–8.1 mm; Miller and Wang 2021: 236). Acknowledging that sample size is greater in East Africa, we doubt that substantiated or meaningful conclusions about late Pleistocene interactions can be drawn from data as limited as these.

Even if this were not the case, the argument that a 'regional network' of 'socially mediated exchange' (Miller and Wang 2021: 237) introduced bead-making to southern Africa and then continued to connect it to populations in East Africa until ~33–19 kya when southern African beads supposedly 'virtually disappear from the archaeological record' (Miller and Wang 2021: 235) is problematic for at least two further reasons. The first is that it ignores several sites that have produced finished ostrich eggshell beads and/or their preforms during the period in question. Table 3 identifies a minimum of nine, possibly as many as 24, such beads, compared to the 14 recognised by Miller and Wang (2021) for the period before 33 kya. There is, we submit, little difference between these small sample sizes, certainly not enough to infer persistent connections in the one case and the virtual disappearance of bead production in the other. Our second point turns on the fact that Miller and Wang's (2021) argument demands the existence prior to 33 kya of multiple, inter-connected bead-making communities and ostrich populations between the most northeasterly South African site with ostrich eggshell beads (Border Cave) and those in southern Tanzania, which are roughly 2700 km apart as the crow flies. However, the few assemblages of relevant age known from geographically intermediate areas of Mozambique, Zambia and Zimbabwe completely lack ostrich bones, ostrich eggshell or ostrich eggshell beads,[2] while close parallels in lithic technology that might substantiate such long-distance connections are also missing (Barham 2000; Mercader *et al.* 2009). Moreover, phytolith-based reconstructions of vegetation indicate the presence of densely wooded environments in northern Mozambique between 55 and 29 kya, environments that would have been wholly unsuitable for ostriches (Mercader *et al.* 2013). Space does not allow us to consider other aspects of the palaeoclimatic drivers that Miller and Wang (2021) invoke to explain the supposed divergence of East and southern African ostrich eggshell bead traditions. Suffice it to say, however, that we think it implausible that 'periodic flooding events' (Miller and Wang 2021: SOM: 18) alone would have prevented people from moving across the Zambezi for over 10,000 years and that in any case available palaeoclimatic records, such as sedimentary cores from Lake Malawi (Brown *et al.* 2007), strongly imply repeated pulsing of wetter *and* drier conditions throughout the late Quaternary (Bradley and Diaz 2021).

Small sample sizes heavily influenced by single, sometimes highly variable, assemblages, a failure to address how beads were recovered in excavation, an absence from the intervening area of beads or other evidence of cultural interaction and problematic palaeoclimatic inferences collectively demonstrate that there is no sound basis for arguing: 1) that southern African hunter-gatherers acquired knowledge of ostrich eggshell bead-making from East Africa; or 2) that they participated in exchange networks with East African populations to maintain supposedly similar bead sizes over thousands of kilometres for thousands of years (*pace* Miller and Wang 2021). More generally, we must ask whether it is realistic to assume that ostrich eggshell beads were only invented once or that similarities in their size alone can demonstrate connectivities over vast spans of time and space? Consider, for example, ostrich eggshell beads dating to 31 kya from Shuidonggou in northern China (Wei *et al.* 2017) the mean diameter (7.69 ± 0.78 mm) and mean aperture size (2.99 ± 0.46 mm) of which are virtually identical to those Miller and Wang (2021) report for their East African Phase 1 and 2 sites. Could a social network extending >10,000 km from East Africa to Inner Mongolia reasonably explain this statistically indistinguishable similarity? We think not.

Myriad archaeological examples exist of shared artefact morphologies across long distances, diverse ecologies and deep stretches of time. Just within Pleistocene Africa, for example, we have the Lupemban and Aterian complexes or, on shorter time-scales and confined to the continent's far south, the Still Bay and Howiesons Poort industries (Barham and Mitchell 2008). All speak to shared, normative learned traditions transmitted and maintained over enormous areas via mobility, marriage, and information flow. However, few would claim that they represent social networks *per se*, and if they did their antiquity would far outstrip that which Miller and Wang assert. Most crucially, bead sizes *on their own* cannot demonstrate exchange, and certainly not 'the furthest Pleistocene stylistic connection ever documented' that Miller and Wang (2021: 237) assert. At best, they may speak to shared traditions arising from mobility and information flow, technological convergence *or* exchange. All are hypotheses to be tested against independent data. How beads were made (i.e. their *chaînes opératoires*) or worn (including studies of use-wear) are both relevant here (cf. Mazel 1989; Wei *et al.* 2017). Stable isotope analyses that may speak to bead provenance and directly document the minimal distances over which beads moved offer another such datum, patterning in other forms of material culture a third. Working back and forth between the evidence of bead measurements and independent data such as these other approaches provide is essential. So, too, is working with as large a sample size of well-dated beads and bead assemblages as possible and working with a high density of both relative to the area of interest. We now discuss our own efforts in this regard.

Tracking ostrich eggshell beads with strontium

Ostriches are generally widespread in southern Africa, but the region's southeastern corner is anomalous in this respect. Historical records show that they were absent in the nineteenth century from the Maloti-Drakensberg Mountains of Lesotho, KwaZulu-Natal and the Eastern Cape, as well as from those parts of KwaZulu-Natal and the Eastern Cape below the uKhahlamba-Drakensberg Escarpment that fall within the Mixed Woodland Savanna and Indian Ocean Coastal Belt Biomes (Shanawany and Dingle 1999; Cooper *et al.* 2009). Review of archaeological excavations in Lesotho, KwaZulu-Natal and the eastern half of the Eastern Cape (roughly equivalent to the former Transkei homeland of the *apartheid* era) shows that this absence is of longstanding. Across an area about half the size of the United Kingdom, finds of ostrich bones and unmodified ostrich eggshell are negligible in the extreme throughout the Holocene. While acknowledging that paintings sometimes show animals that cannot have lived close to where they were depicted (e.g. Ouzman 1995 with reference to mormyrid fish, again in southeastern southern Africa), we find it significant that, in Patricia Vinnicombe's (1976: 204) words, ostriches are likewise 'notably rare'. Indeed, her own survey of over 300 rock art sites in highland Lesotho and adjacent parts of KwaZulu-Natal produced precisely zero records of them. So, too, did that of Mazel (1980), which recorded a further 350 or so sites (and 19,000 images) in the northern half of the uKhahlamba-Drakensberg Escarpment.[3]

Consistent with these data, if we look at the ostrich eggshell beads recovered from hunter-gatherer contexts in this southeastern region then it quickly becomes apparent that most fall within Orton's (2008) Stage VII, i.e. they are completely ground and finished (Table 4). Instances of Stages I–VI, which encompass production from initial modification of a fragment of eggshell through drilling the hole to trimming of the edge and a start on grinding it smooth, are extraordinarily uncommon. At Sehonghong in highland Lesotho, for example, finished beads account for almost the entirety of a sample of 529 extending from the Last Glacial Maximum into the nineteenth century AD.[4] To be more specific, here there are precisely no instances of Orton's Stages I–V, with all the beads recovered having been either completely (97.7%, N = 517) or partly (2.3%, N = 12) ground smooth (Plug and Mitchell 2008). The same pattern extends across other sites in highland Lesotho, the northern and eastern Eastern Cape and south of the Thukela River in KwaZulu-Natal, including sites in the uKhahlamba-Drakensberg Escarpment. Exceptions exist only to the north of the Thukela, where on-site bead-making is strongly in evidence throughout the mid/late Holocene sequence at Maqonqo (Mazel 1996) and, on a much smaller scale, in the late Holocene at Sikhanyisweni (Mazel 1988a) or in the Caledon Valley along the border between Lesotho and the Free State (Mitchell 1993a, 1993b; Mitchell and Arthur 2014).

In a preliminary project reported a few years ago (Stewart *et al.* 2020) we showed how strontium isotopes could be used to help identify the sources of ostrich eggshell beads in southern Africa. Put simply, the ratio between two isotopes of strontium, ^{87}Sr and ^{86}Sr, varies from one bedrock type to another. Although atmospheric dust, precipitation and — close to the shoreline — sea-spray can all contribute to the strontium present in soil, bioavailable strontium derives overwhelmingly from bedrock weathering. The ratio between the two isotopes does not undergo fractionation in plants or animals and thus remains unchanged as it passes up the food chain, making strontium isotopes ideal for identifying the geological background from which items of interest — in this case ostrich eggshell beads — derive. Happily, the geology of southern Africa is dominated by rocks of the Karoo Supergroup, the different phases of which formed between 300 and 180 million years ago. The lavas of the youngest unit, the Drakensberg Group, are thickest in the Maloti-Drakensberg Mountains. Their erosion beyond this, and that of older units that underlie them further afield, has produced an off-centre concentric geological pattern in which the Drakensberg Group is first surrounded by the sandstones of the Stormberg Group's Clarens Formation and then by the sandstones, shales and mudstones of its predecessors, the Molteno and Elliot Formations, beyond which still older rocks of the Beaufort, Ecca and Dwyka Groups are now exposed. Geographically peripheral to the Karoo Supergroup, the bedrock geologies of the Cape Fold Mountain Belt, Namaqualand, northern South Africa from the Richtersveld east to the Mozambique border and areas further south bordering eSwatini or in lowland parts of KwaZulu-Natal are either much more ancient or significantly younger. All have distinctive strontium isotope signatures for which plants growing on them, or non-migratory small mammals such as rodents, form proxies readily amenable to sampling.

Table 4. Finished ostrich eggshell beads and preforms from hunter-gatherer contexts in southeastern southern Africa postdating the Last Glacial Maximum. Attribution of beads to Orton's (2008) stages is inferred from the original publications and has not been confirmed, except with respect to data from Lesotho, by our own re-examination of any of the assemblages.

Region and site (FS = Free State; L = Lesotho)	Finished beads (Orton (2008) Stage VII)	Incompletely ground beads (Orton (2008) Stage VI)	Preforms (Orton (2008) Stages I–V)	References
Caledon Valley				
Adullam (FS)	11	-	3	Wadley and Laue (2000)
Ha Makotoko (L)	200	9	50	Mitchell (1993a); Mitchell and Arthur (2014)
Leliehoek (FS)	11	-	-	Esterhuysen *et al.* (1994)
Liphofung (L)	6	-	-	Kaplan and Mitchell (2012)
'Muela (L)	7	-	-	Kaplan and Mitchell (2012)
Ntloana Tšoana (L)	5	-	-	Mitchell (1993a, unpublished)
Rooikrans (FS)	2	-	-	Thorp (2000)
Rose Cottage Cave (FS)	69	-	20	Wadley (1996, 2000a, 2000b)
Tloutle (L)	132	12	79	Mitchell (1993b)
Twyfelpoort (FS)	16	-	-	Backwell *et al.* (1996)
2927BC1 (L)	-	2	-	Mitchell (unpublished)
Highland Lesotho				
Bolahla	52	-	1	Mitchell *et al.* (1994)
Likoaeng	64	-	-	Mitchell (unpublished)
Moshebi's Shelter	2	-	-	Carter (1969)
Pitsaneng	34	-	-	Hobart (2003)
Sehonghong[1]	529	12	-	Mitchell (1995, 1996a, 1996b); Plug and Mitchell (2008)
2928DB29	2	-	-	Mitchell (unpublished)
2928DB33	4	-	-	Mitchell (unpublished)
2928DB34	36	-	-	Mitchell (unpublished)
Northern and eastern Eastern Cape Province[2]				
Bonawe	1	-	-	Opperman (1987)
Colwinton	16	-	-	Opperman (1987)
Ebb and Flow Bridge	1			Derricourt (1977)
Ravenscraig	16	-	-	Opperman (1987)
Te Vrede	8	-	-	Opperman (1987)
Tsakana Falls Cave	1	-	-	Derricourt (1977)
Waterfall Bluff	1	-	-	Fisher *et al.* (2020)
KwaZulu-Natal south of the Thukela Basin				
Belleview	1	-	-	Carter (1978)
Borchers Shelter	32	-	-	Cable (1984)
Good Hope	4	-	-	Cable *et al.* (1980)
Ingane Shell Midden A	32	-	-	Schoute-Vanneck and Walsh (1959)
Umbeli Belli	4	-	-	Cable (1984)
Umhlatuzana	32	-	-	Kaplan (1990)
KwaZulu-Natal (Upper Thukela River catchment				
Collingham Shelter	18	-	-	Mazel (1992)
Diamond 1	1	-	-	Mazel (1984)
Driel	18	-	-	Maggs and Ward (1980)
eSinhlonhlweni	8	-	-	Mazel (1986a)
iNkolimahashi	1	-	-	Mazel (1999)

(*Continued*)

Table 4. Continued.

Region and site (FS = Free State; L = Lesotho)	Finished beads (Orton (2008) Stage VII)	Incompletely ground beads (Orton (2008) Stage VI)	Preforms (Orton (2008) Stages I–V)	References
kwaThwaleyakhe	3	-	-	Mazel (1993)
Mbabane	14	-	-	Mazel (1986a)
Mgede	32	-	-	Mazel (1986b)
Mhlwazini	38	-	-	Mazel (1990)
Nkupe	63	-	-	Mazel (1988b)
KwaZulu-Natal (Buffalo River catchment				
Maqonqo	153	-	368	Mazel (1996)
Mzinyashana 1	161	-	-	Mazel (1997)
Sikhanyisweni	29	-	5	Mazel (1988a)

1. Note that the figures given here for Sehonghong exclude the 43 beads recovered by Carter (1978) since we are unsure if any belong to Stage VI. However, his data do confirm the results of the 1992 excavation in excluding the presence of bead preforms at the site.
2. Laidler (1937) notes the presence of ostrich eggshell beads and pieces of ostrich eggshell at another site, Ngicsininde, but provides no numerical data or further details.

Using these sources, we first determined isotope values across the Drakensberg Group and Clarens Formation, drawing on published data (de Villiers *et al.* 2000) for geologies beyond this. We then analysed the strontium isotope composition of 27 beads from highland Lesotho, 16 from Sehonghong and 11 from Melikane, another large rock-shelter some 25 km to its south. The Melikane beads all date to the latter part of the Holocene (<3300 BP), whereas those from Sehonghong sample a much longer period extending from the late Holocene (<1300 BP) to the latter part of Marine Isotope Stage 3 (~32 kya). All the beads sampled are non-local, consistent with the archaeological evidence discussed earlier for ostriches and ostrich eggshell bead-making having been absent from highland Lesotho. Moreover, we found almost no overlap between the signatures of our beads and that of the Upper part of the Stormberg Group. Rather, our data imply that the beads analysed from Melikane and Sehonghong mostly come from areas underlain by older lithologies belonging to the Lower Stormberg, Beaufort and Ecca/Dwyka Groups.

The spatially skewed patterning of the Karoo Supergroup's geology means that its full succession is exposed much nearer highland Lesotho to the west than to the east, raising the possibility that beads could, in theory, be sourced from eggs laid just below the uKhahlamba-Drakensberg Escarpment. However, bead-making debris and eggshell fragments are almost completely absent south of the Thukela River (Mazel 1989), although, as noted above, to its north in an area where Ecca rocks outcrop they occur prolifically at Maqonqo and on a much smaller scale at Sikhanyisweni (Mazel 1988a, 1996). While it is therefore possible that ostriches were locally present north of the Thukela, ornithological records suggest that at least in the nineteenth century they occurred no closer than the northeastern Free State, some 150 km away, the area that Mazel (1996: 32) identified as the most likely source of the beads and worked eggshell present at Maqonqo. In any event, archaeological evidence strongly suggests that the southern half of KwaZulu-Natal and the eastern parts of the Eastern Cape were consistently free of ostriches throughout the late Quaternary and could not therefore have supplied beads to highland Lesotho. Instead, those beads must have come from areas broadly to the *west* of the Maloti Mountains, where, as we discuss below, the closest sites with evidence of on-site manufacture are Ha Makotoko (Mitchell 1993a; Mitchell and Arthur 2014) and Tloutle (Mitchell 1993b).

Returning to our strontium isoscape and translated (somewhat implausibly) into straight line travel as the hunter-gatherer walks, this means that most of the beads analysed from Melikane and Sehonghong had moved over distances of at least 109–164 km from their closest possible geological source. However, this is a minimum: the statistical agreement between the $^{87}Sr/^{86}Sr$ ratios of the beads we have analysed and those of the Ecca/Dwyka Group suggests that most come from habitats underlain by this oldest Karoo Supergroup unit. Such habitats extend 1000 and more kilometres from Melikane and Sehonghong. Additionally, three of our beads come from Pre-Cambrian geologies that are even further afield than the Ecca/Dwyka Group. Dating to MIS 3, the Younger Dryas stadial and the late Holocene respectively, these particular beads must have travelled over >325 km to reach highland Lesotho, potentially much more than this. Having demonstrated the applicability of strontium isotope analysis to identifying the origin of ostrich eggshell beads in southern Africa (an effort that has been paralleled much further west in Namibia; Kinahan 2020), we look forward to extending it in future work to a much larger sample that is more broadly representative in both time and space, including sampling additional mid- and late Holocene contexts from highland Lesotho, as well as beads dating to the Last Glacial Maximum. Additionally, we plan to extend our analysis across the region to include sites in KwaZulu-Natal, lowland (i.e. western) Lesotho and the eastern Free State.

Making connections: strontium, bead metrics and other data

To explore how patterning in the isotopically inferred sources of ostrich eggshell beads in southeastern southern Africa relates to other evidence of interaction across this extensive, topographically and ecologically diverse region, we have initiated our own study of bead metrics. When completed, we anticipate that this will include at least 41 sites, six from South Africa's Free State province, 23 from KwaZulu-Natal and ten, possibly more, from Lesotho, covering a total area of around 100,000 km^2 (Table 5). We include within this sample both those sites that are generally understood to have been occupied by Later Stone Age hunter-gatherers and several others in KwaZulu-Natal that represent farming villages of the first millennium AD to which ostrich eggshell beads are generally considered to have been introduced via exchange with foragers (Maggs 1980; Whitelaw and Mazel 2023). Excavations at these sites have largely been undertaken by just three institutions, the KwaZulu-Natal Museum, the University of the Witwatersrand and the University of Oxford, and often by the same individuals. Sieving procedures are known and uniformly employed relatively small mesh sizes (<3.0 mm). Loss of ostrich eggshell beads and variation in retrieval rates between sites are thus considered to have been minimal.

Recording procedures have heeded the advice offered by previous researchers. Wherever possible — and for all beads currently housed at the University of the Witwatersrand and the KwaZulu-Natal Museum, which we measured in 2022 — this involves photographing each individual bead using a digital microscope and taking measurements of bead diameter and internal aperture size in the freeware programme ImageJ, while

Table 5. Sites with ostrich eggshell bead assemblages to be measured in southeastern Africa.

Site	References
Free State	
Adullam	Wadley and Laue (2000)
De Hoop	Klatzow (2000)
Leliehoek	Esterhuysen *et al.* (1994)
Rooikrans	Thorp (2000)
Rose Cottage Cave	Wadley (1996, 2000a, 2000b)
Twyfelpoort	Backwell *et al.* (1996)
Lesotho	
Bolahla	Mitchell *et al.* (1994)
Ha Makotoko	Mitchell (1993a); Mitchell and Arthur (2014)
Likoaeng	Mitchell (unpublished)
Ntloana Tšoana	Mitchell (unpublished)
Pitsaneng	Hobart (2003)
Sehonghong	Mitchell (1995, 1996a, 1996b); Plug and Mitchell (2008)
Tloutle	Mitchell (1993b)
2928DB29	Mitchell (unpublished)
2928DB33	Mitchell (unpublished)
2928DB34	Mitchell (unpublished)
KwaZulu-Natal – Hunter-gatherer sites	
Collingham Shelter	Mazel (1992)
Diamond 1	Mazel (1984)
Driel	Maggs and Ward (1980)
Eland Cave	Aron Mazel (pers. comm., 17 May 2024)
eSinhlonhlweni	Mazel (1986a)
iNkolimahashi	Mazel (1999)
kwaThwaleyakhe	Mazel (1993)
Maqonqo	Mazel (1996)
Mbabane	Mazel (1986a)
Mgede	Mazel (1986b)
Mhlwazini	Mazel (1990)
Mzinyashana	Mazel (1997)
Nkupe	Mazel (1988b)
Sikhanyisweni	Mazel (1988a)
Umbeli Belli	Cable (1984)
Umhlatuzana	Kaplan (1990)
KwaZulu-Natal - Farmer sites	
Emberton Way	Horwitz *et al.* (1991)
KwaGandaganda	Whitelaw (1994)
Magogo	Maggs and Ward (1984)
Mhlopeni	Maggs and Ward (1984)
Msuluzi Confluence	Maggs (1980)
Nanda	Whitelaw (1993)
Ndondondwane	Maggs (1984)
Ntshekane	Maggs and Michael (1976)
Wosi	van Schalkwyk (1994)

using hand-held digital callipers to record bead thickness (Wilmsen 2015; Miller and Wang 2021: SI: 23). We plan to remeasure the large assemblage from Sehonghong in the same way, but in the meantime employ measurements made using digital callipers for it and the bead assemblages from several other Lesotho sites. Noting the importance of minimising inter-observer error, all measurements made in 2022 on beads from the Free State and KwaZulu-Natal were made by just one of us (Hopper), all calliper-based measurements for beads from Lesotho by another (Mitchell). Although we are unable to address Wilmsen's (2015: 95) further point regarding the effect of sediment pH on ostrich eggshell chemistry, the fact that almost all our hunter-gatherer sites come from sandstone contexts may minimise its impact here.

As recommended by Wilmsen (2015) and Miller and Sawchuk (2019), we intend to present our final data by plotting the measurements for individual beads to build a finer grained picture than summary statistics alone can provide, one that may be better able to 'capture subtle variability within levels and time periods that is masked when bead averages are reported by level.' (Miller and Sawchuk 2019: 2). However, we also plan to engage in robust statistical analysis of the bead sizes characterising assemblages across the region to further identify similarities and differences in space as well as time.

At this preliminary stage it is difficult to offer firm conclusions. However, one potential finding of interest concerns the early and mid-Holocene bead assemblages from Sehonghong and those from two other sandstone rock-shelters in western Lesotho, Ha Makotoko and Tloutle. As Table 6 shows, beads from these assemblages are very similar in size, with mean diameters all in the range 4.2 ± 0.7 to 3.73 ± 0.58 mm across a period of some 4000 years. Recall, here, that the ostrich eggshell beads from Sehonghong must have been introduced there from outside highland Lesotho and that our isotope analysis showed that those dating to its early Holocene ALP layer have strontium ratios indicating a provenance from areas with bedrock geologies of the Lower Stormberg, Beaufort and/or Ecca/Dwyka Groups (Stewart *et al.* 2020). The Lower Stormberg Group outcrops in western Lesotho, where both Ha Makotoko (Mitchell 1993a) and Tloutle (Mitchell 1993b) have evidence of on-site ostrich eggshell bead manufacture. Is it possible that this area — perhaps even these sites — were involved in the transmission of beads eastward over the Front and Central Ranges of the Maloti Mountains and into the Senqu Valley where Sehonghong lies? While posing a degree of topographic challenge since these ranges reach up to >2500 m a.s.l., the distance involved is no more than 200 km, a journey that could be accomplished in under a week. But is there any further evidence to suggest that a connection of this kind — between eastern and western Lesotho — existed during the early or middle Holocene? One possible signal comes from Ha Makotoko, where excavations in 1989 retrieved three *Nassarius*

Table 6. Ostrich eggshell bead measurements from early and mid-Holocene contexts in Lesotho. Note that Sehonghong is in Lesotho's eastern highlands, while Ha Makotoko and Tloutle are in its western lowlands.

Site	Layer	Calibrated age (kya)	Mean bead diameter (mm)	Mean bead aperture (mm)	Number of beads	Mesh size used (mm)
Sehonghong	GWA	6.7	3.71 ± 0.56	1.56 ± 0.38	104	1.5
Tloutle	CCL	7.0	4.2 ± 0.46	1.9 ± 0.34	41	2.0
Tloutle	CSL-UP	7.7	4.0 ± 0.73	1.91 ± 0.58	24	2.0
Tloutle	CSL-LR	8.0	3.8 ± 0.75	1.8	2	2.0
Sehonghong	ALP	8.0–7.8	3.9 ± 0.78	1.58 ± 0.48	174	1.5
Tloutle	GS	9.6	3.93 ± 0.61	1.41 ± 0.25	35	2.0
Ha Makotoko	GWA	9.3	4.25 ± 0.7	1.5 ± 0.2	20	2.0
Ha Makotoko	BLOS-UR	10.0	4.16 ± 0.6	1.5 ± 0.3	39	2.0
Sehonghong	SA	11.0–10.4	4.19 ± 0.67	1.52 ± 0.31	40	1.5
Ha Makotoko	BLOS-LR	11.6–10.4	3.9 ± 0.7	1.4 ± 0.2	44	2.0

kraussianus shell beads (Mitchell 1993a). Their significance lies in the fact that this is an estuarine species, the nearest source of which would have been in the mouths of rivers entering the Indian Ocean, approximately 180 km to the east of Sehonghong in KwaZulu-Natal. Confirmation of links between Sehonghong and the coast during the same early and mid-Holocene phases comes from further *N. kraussianus* beads and other ornaments of marine shell found there (Plug and Mitchell 2008).

As we explore patterning in ostrich eggshell bead measurements across southern Africa, we hope to gain a better understanding of the variability in bead sizes within and among regional forager groups, both coeval and across time. An understanding of this variation — and, crucially, its sources — is needed before inferences regarding long-distance exchange can be made. We remain highly sceptical that metric data alone, without corroborating evidence such as strontium isotopes, can be used to establish exchange networks over large geographical areas across thousands of years. Stylistic preference is but one variable that may have factored into decisions regarding which sized beads to make and exchange, with design considerations (e.g. stranded, sewn) and the identity of the intended giftee (e.g. age, sex, status) among the other possible considerations. Working with as large and robust a sample size as possible, we shall therefore evaluate possible connections against multiple other datasets.

As in the case we have just sketched, strontium isotope analysis of ostrich eggshell beads and spatial patterning in coastally derived marine or estuarine shell ornaments are two of these. Other lines of argument open up with the possibility of adding lead isotopes to strontium (cf. Scott *et al.* 2020) and of applying both isotopic signals to other faunal materials that may have moved across the precolonial landscape. As well as rare instances of ostrich bones found in out-of-area contexts (for example, a fibula from Likoaeng in highland Lesotho; Plug *et al.* 2003), such material includes several instances of bones identified as belonging to blue duiker (*Philantomba monticola*) and red duiker (*Cephalophus natalensis*) — species restricted to near-coastal forest habitats — occurring far inland in grassland settings (Plug 1997). Patterning in stone tools provides other ways forward, whether in the raw materials that people preferred when making them or in the distribution of specific artefact forms that almost certainly encoded symbolically significant information, such as pressure-flaked arrowheads and backed microliths (Mitchell 1996c, 1999). We do not expect that these data will always concur with each other, but we do anticipate finding other instances of overlap that may suggest something of the reality of past networks of connection within southeastern southern Africa. Beads made from the eggshell of the continent's most peculiar bird, the ostrich, are likely to have been key items flowing through those networks, linking communities together, building ecological resilience and reproducing cherished social relations. Their exoticness in most of our region and the supernatural qualities that this may have helped enhance are, we think, likely to have been among the reasons for this.

Notes

1. Carter (1978)'s trench, which extended to bedrock, covered approximately 9 m^2, while Mitchell (1996) excavated over an area of approximately 13 m^2 in 1992 (both areas are estimates because of the variable configuration of the rear wall of the shelter, which truncated squares M8–9 and M12–13 respectively. Mitchell's excavation removed approximately 12.5 m^3 of deposit from

stratigraphic contexts equivalent to Layers VI–X in Carter *et al.*'s (1988) presentation of the site, which broadly equate to Spits 1–11 of Carter's (1978) excavation and thus account for some 9.9 m^3 of deposit. Comparing now the total number of beads recovered in the two excavations (N = 43, Carter (1978); N = 529, Plug and Mitchell (2008)), this yields densities of 4.34 beads per metre of deposit in the 1971 Carter trench but 42.32 beads per metre of deposit in Mitchell's trench of 1992. This order of magnitude difference is implausibly high unless we take the differences in recovery methods into account.

2. Thompson (2024) nevertheless notes the presence of a 'large quantity' of ostrich eggshell and ostrich eggshell beads and bead preforms at sites in the Kasitu Valley of northern Malawi in contexts dating to between 30,000 and 5,000 years ago. This is in an area of Africa from which ostriches were completely absent in the later Holocene and historical times, suggesting major changes in their distribution over the late Quaternary. However, these results all fall *after* the window identified by Miller and Wang (2021).
3. A single image of an ostrich is, however, present at Sorceror's Rock, Didima Gorge (Pager 1971), a part of the northern uKhahlamba-Drakensberg of KwaZulu-Natal not covered by Mazel's survey. We are grateful to Aron Mazel for informing us of this site.
4. This sample refers to the beads excavated at Sehonghong in 1992 by Mitchell (1995, 1996a, 1996b; Plug and Mitchell 2008). The total for the site given in Table 4 includes one further finished bead recovered in later excavations by Stewart and Dewar (Stewart *et al.* 2020).

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