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Catalytic Environments

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ABSTRACT
The metaphor of catalytic environments adequately accentuates the key role of natural factors in social change without superseding the significance of human agency. In this approach, natural resources are integrated into social practices and strategies while avoiding an environmentally deterministic perspective. The case study of MC-6, Middle Caicos, Turks & Caicos Islands, demonstrates how the natural availability of salt, fish, and cotton affected processes of social change, including settlement practices, food procurement strategies, and long-distance exchange. The inhabitants of MC-6 chose these resources within a social framework of historic practices and regional interaction, while simultaneously depending on local natural conditions and environmental factors. Although environmental diversity in the Caribbean highlights the relevance of catalytic environments, this approach is a tool to examine the dialectic interaction between humans and environments at a global scale.

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Environmental archaeology studies in the Caribbean provide powerful frameworks for understanding past human practices across a variety of landscapes and biodiversity (deFrance 2013; deFrance et al. 2010; Fitzpatrick et al. 2008; Keegan, Portell, and Slapcinsky 2003). The region's natural diversity provides opportunities to archaeologically examine social practices through an environmental lens, including relationships between settlement locations, exploitation strategies, economy and locally available resources across space and time (e.g. DuChemin 2013; Grouard 2002; Keegan, et al. 2008; Steadman and Jones 2006).

In this paper, I discuss multiple lines of environmentally-derived data, including sediment from a salt pond and vertebrate zooarchaeological data from an adjacent archaeological site, as a foundation for interpreting an annual cycle of economic production and social practice at the precolonial MC-6 site located on Middle Caicos, Turks & Caicos Islands. Within the context of a relatively short span of occupation at the site (±AD 1300–1650), the data indicate a close relationship between the site's inhabitants and naturally available resources and highlight how a combination of environmental and social conditions intrinsically influenced economic production. Resources, including salt from Armstrong Pond, fish from the Caicos Bank, and cotton were immediately available to people living at MC-6. Yet, the mere presence of resources does not explain why permanent villages, such as MC-6, were only established in the Turks & Caicos after centuries of intermittent visits from Hispaniola. To grasp the dynamic interactions between resources and people, and to explain how the environment may have influenced settlement decisions and structured production, I introduce the metaphor of catalyser to understand how environments can act as important agents in social change without being a determining factor. This approach holds great potential for environmental archaeology studies drawing on multiple datasets and scales of analysis aimed at elucidating the challenging interplay of environmental and social factors during the past.

The following section outlines the 'Catalytic' perspective of environment-human dynamics advocated for in this paper, providing an interpretive framework for the data on economic production at MC-6. Next, environmental datasets are discussed in reference to salt production, targeted fishing, and cotton cultivation at MC-6. The data are then considered in terms of object materiality and seasonal temporality. The paper concludes with an argument for viewing environmental and social conditions of economic production as a 'Catalytic Environment' predicated upon intimate entanglements of human knowledge and decision making, and the conditions of natural resource availability.

Catalytic Environments

Objects are fundamental agents in the formation, negotiation, and maintenance of social relations (Gell 1998; Ingold 2007; Jones 2005; Latour 2005; Miller 1998; Thomas 1999). As objects, natural parameters have a similar potential to affect people's practices and induce change. This ability to influence social practices is what I refer to as the materiality of the environment, an

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approach which allows for a role of the environment without being environmentally deterministic. The metaphor of catalyser explains how environments can act as an important agent in social change without being a determining factor. A catalyser is an integral part of the process of transformation; it facilitates and accelerates courses of change without being changed itself. Catalysers also affect outcomes of processes, as they need to be present for the processes to take place. More important, the function of a catalyser is determined by its context. Without the presence of certain substances in its immediate vicinity, the catalyser remains inert. In other words, the catalyser remains passive until the moment context-specific circumstances occur, initiating its activity.

Translating the term catalyser to environments involves acknowledging the dialectic relationship between environments and humans. Environments and people are not predetermined entities in space, but become socially integrated and entangled through interaction in a lived-in world (Heidegger 1977; Hodder 2012; Ingold 2007, 2012). Within such context, it is possible to envision how environments can initiate certain practices, entice people to make decisions, and induce change without changing itself. For example, the invention of watercrafts can be as much contributed to the ingenuity of people as to the existence of waterbodies. Without water, people would never need to come up with a solution. Yet, the physical properties of water were unaltered by the invention of watercrafts.

As the case study here will show, environments only function as catalysers of social change when people make the decision to interact with specific environmental materials. It is not the material quality of the environment per se, but the way people utilise these material qualities in social relations that induce change. Social awareness of material qualities is, therefore, just as important as the awareness of social processes of change. In the case of watercrafts, it was a conscious decision to create an object that would facilitate mobility over water, and people realised that certain materials, such as wood, would be better suited for this endeavour than, for example, a granite slab. In this article, I will show how environments often acts as catalysers in more subtle and less obvious ways, and how this metaphor provides a framework of understanding how the relationship between the environment and people unfolds and creates change.

The MC-6 Archaeological Site

Located on Middle Caicos, Turks & Caicos Islands, the archaeological village site MC-6 borders the southern edge of dry land (Figure 1). Although a seven-kilometer-wide salina now separates MC-6 from the vast Caicos Bank, it is believed that the sea reached the site during its precolonial occupation (Keegan 2007). The largest salt-producing pond in the Caicos Islands, named Armstrong Pond, is located north of the site and away from the bank. Typical of limestone islands in the region, soils at MC-6 are relatively poor and the topography is flat. The climate is hot and dry with very low precipitation that is concentrated during the rainy season between May and June.

The site has been examined intermittently over four decades, providing details about its spatial and temporal dimensions (Keegan 2007; Morsink 2012; Sullivan 1981). With over 50,000 sherds identified from a pedestrian survey (Sullivan 1981), the site is the largest known precolonial settlement in the Bahamian archipelago and has many unique architectural features. First, MC-6 is the only known site in the Caribbean archipelago composed of two C-shaped midden areas surrounding an artificially constructed plaza (Keegan 2007; Sullivan 1981; Figure 2). Second, stone alignments and a stone placed in the centre of this plaza do not function as delineations of a ball court, such as those famously present at precolonial sites on Puerto Rico and elsewhere in the Caribbean region (Curet and Stringer 2010; Oliver 1998; Torres 2012). Rather, these alignments have very specific angles marking rising and setting points that have been interpreted as referencing important celestial bodies (Sullivan 1981). These include the sun and several of the brightest stars in the night sky (e.g. Sirius, Betelgeuse, Fomalheut). Finally, a 'road' – two parallel rows of stones set a few metres apart and filled in with sandy deposits – connects MC-6 to Armstrong Pond (Sullivan 1981). No other archaeological site in the Caribbean islands has similar architectural features or a comparable layout, underlining the unique character of this settlement (Keegan 2007; Morsink 2012; Sullivan 1981).

The location and features of MC-6 are significant to Greater Antillean and Bahamian archaeology in terms of inter-island interaction and trans-archipelago relationships. Historic sources and archaeological studies have pointed to the Greater Antilles as the heartland of Taíno culture at the time of contact (Keegan 2013; Rouse 1992). The Taíno were a product of social transformation of distinct groups into a regionally connected political economy and encompass a wide range of peoples (Keegan 2013; Keegan and Hofman 2016; Oliver 2009). The Bahamas, on the other hand, were physically distanced from the Taíno of The Greater Antilles. The Bahamas and Turks & Caicos Islands were occupied by groups of people referred to as Lucayan (ca. AD 700/800 – European Contact). Archaeological evidence, such as pottery from Hispaniola found at MC-6, indicates that Taíno and Lucayan groups engaged in long-distance interaction and exchange (Berman, Gnivecki, and Pateman 2013; Keegan 2007; Keegan and Hofman 2016; Sullivan 1981). Despite constant interaction and exchange between

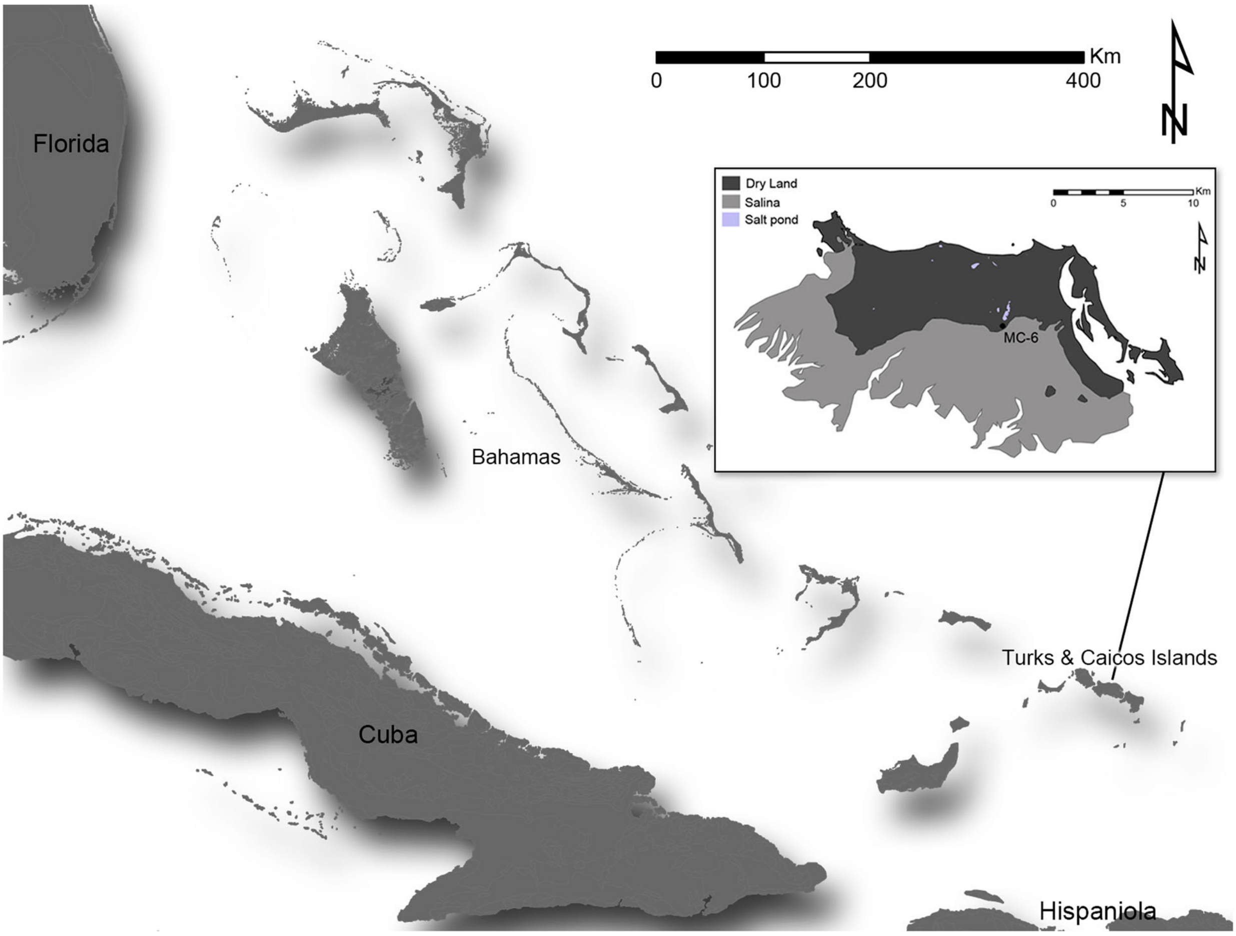

Figure 1. General location of MC-6 on Middle Caicos,Turks & Caicos Islands within the Caribbean archipelago.

the two regions, differences in material culture, namely the localised production of Palmetto ware pottery across the Bahamian archipelago, suggest the presence of some cultural distance, or material differentiation, between the Taíno heartland and the Bahamian archipelago. Palmetto ware is characterised as a shell-tempered, red pottery style only found among The Bahamas and Turks & Caicos Islands and is the dominant pottery style present at MC-6. Palmetto ware pottery was ubiquitous throughout the Bahama archipelago by AD 1000.

In terms of local history, Middle Caicos and the Turks & Caicos Islands have a relatively short timeframe of human occupation. Initial colonisation of the islands did not start until after AD 700 (Carlson 1999; Keegan 1992, 1997, 2007). The earliest sites are composed of Ostionan and, later, Meillac pottery wares imported from Hispaniola and contain low-density artifact scatters. Faunal assemblages at these sites represent intermittent, specialised resource extraction of mollusks, fish, and locally available tortoises during visits from groups living on Hispaniola (Carlson 1993, 1999). After AD 1000, these intermittent visits from Hispaniola seem to have halted and permanent villages were established by Lucayan groups already present in the central Bahamas (Keegan 2007). While the origin of these settlers is the topic of current debate, current interpretations suggest that they originated in Cuba and settled in the central Bahamas (Berman and Gnivecki 1995; Berman, Gnivecki, and Pateman 2013).

Materials, Methods, and Results

Historical Developments at MC-6

To investigate how environments catalysed social processes at MC-6, a detailed reconstruction of changes in local environment and population is fundamental. Previous investigations at the site relied on the assumption that Armstrong Pond was present and produced salt when MC-6 was inhabited. Furthermore, habitation was estimated between AD 1200 and 1500, based on the pottery identified at the site (Sullivan 1981). These assumptions do not provide the resolution needed to investigate the dynamic interaction between people and environmental factors, and required a more in-depth analysis.

Generally, soils are very shallow on Middle Caicos, and the limestone bedrock is located close to the surface. To identify deep stratigraphic profiles exposing historical developments of human occupation, a test unit excavation was placed on top of the C-shaped

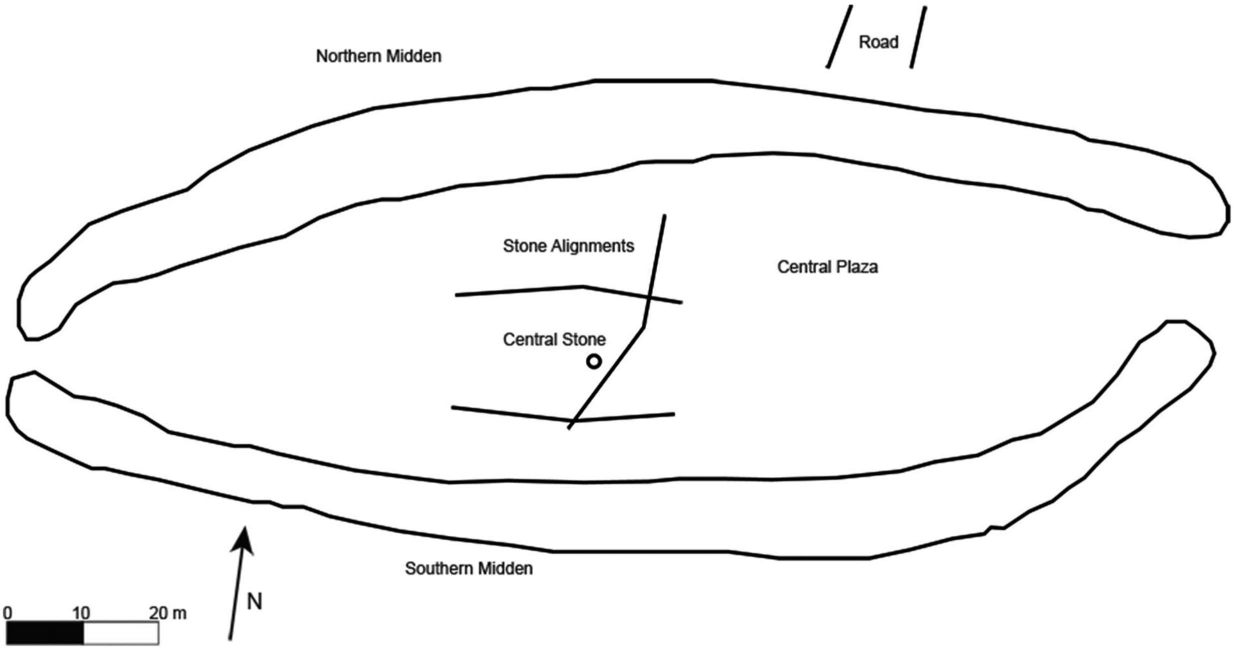

Figure 2. Plan of MC-6, showing the location of the C-shaped midden, road, and stone alignments in the main plaza (adapted from Sullivan 1981).

midden. The midden consisted of nine strata on top of bedrock. Five different strata were dated using charcoal samples, providing comprehensive chronological control of human occupation at the site (Figure 3). All samples were calibrated following Reimer et al. (2009).

People moved to MC-6 at the beginning of the 14th century, as evidenced by the earliest known date for the site derived from the bottom of the midden deposit on the C-shaped ridge (cal AD 1308–1361, Table 1). Dates from superimposing strata have a similar range around the beginning of the 14th century and the beginning of the 15th century, except for the sample from the top of the midden deposit. This sample yielded a much later date, at a 2 σ range cal AD 1497–1636 (Morsink 2012). These dates suggest that the C-shaped midden was built up in a relatively short period of time, starting in the 14th century, and people occupied the area for 300 years.

Initial habitation for MC-6 occurred relatively late in relation to other permanent villages on Middle Caicos (Keegan 2007), later than previously assumed based on pottery assemblages at the site, and many centuries after intermittent visits from Hispaniola. This poses a critical problem for explaining the site's significance in terms of economic exploitation of salt and other resources, as it begs the question of why people would wait for centuries to start this endeavour. This is further complicated by the fact that the midden seems to have been built quickly, implying some form of deliberate investment in the area, possibly connected to people recognising the potential of these resources. In the following sections, I present evidence

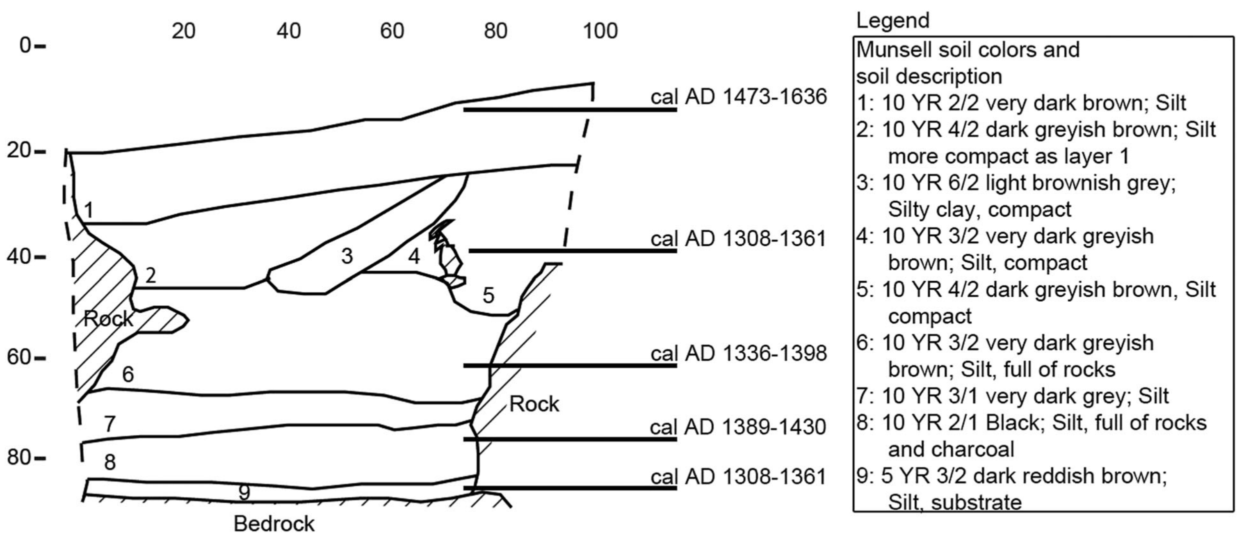

Figure 3. North profile of unit excavation in midden area, showing nine stratigraphic levels with associated radiocarbon dates.

Table 1. Radiocarbon dates from MC-6. Midden samples (charcoal) used intcal09.14c and core samples (shell) Marine/INTCAL09 (Reimer et al. 2009).

Lab#	Context	Conventional C14 Age (BP)	Calibrated 2 Sigma (AD) 95% probability
UGAMS 8772	Midden	470 ± 25	1415–1451
UGAMS 8773	Midden	580 ± 25	1304–1364 and 1384–1414
UGAMS 8774	Midden	550 ± 25	1317–1354 and 1389–1430
UGAMS 8775	Midden	610 ± 25	1297–1374 and 1376–1401
UGAMS 8776	Midden	470 ± 25	1415–1451
UGAMS 8777	Midden	340 ± 25	1473–1636
UGAMS 8778	Midden	570 ± 25	1308–1361 and 1386–1419
UGAMS 8779	Midden	620 ± 25	1293–1333 and 1336–1398
UGAMS 8780	Midden	550 ± 25	1317–1354 and 1389–1430
UGAMS 8781	Midden	570 ± 25	1308–1361 and 1386–1419
UGAMS 8763	Core	840 ± 25	1314–1450
UGAMS 8764	Core	620 ± 25	1424–1534, 1558–1563, 1573–1583, and 1592–1619
UGAMS 8765	Core	830 ± 25	1297–1418
UGAMS 8766	Core	1110 ± 25	1077–1085 and 1098–1292
UGAMS 8767	Core	1400 ± 25	729–746 and 765–973
UGAMS 8768	Core	2840 ± 30	BC 845–581
UGAMS 8769	Core	3000 ± 25	BC 1005–798
UGAMS 8770	Core	4360 ± 30	BC 2849–2544 and 2521–2498
UGAMS 8771	Core	4190 ± 30	BC 2566–2300

for and argue that the economic focus of this village was the exploitation of salt from Armstrong Pond, fish from the Caicos Bank, and cotton produced at nearby gardens (Morsink 2012). I further argue that there is a direct relationship between the location of MC-6 and the availability of local resources, explaining the timing of occupation and why people waited until the 14th century to build MC-6.

Armstrong Pond

Armstrong Pond is approximately 1.5 km long and 200 m wide. The pond is shallow and bordered by limestone rock in the east and northwest and sand in the southwest. Direct evidence of salt exploitation in the past is absent, as salt is naturally formed each year in large quantities and people could have easily collected the resource using technology that is not archaeologically visible. This also applies to the possibility of salt pans, which are not recognised at Armstrong Pond. However, small anthropogenically-derived V- and C-shaped lines of rock along the southwestern border may evidence activities involving exploitation in the past. In fact, some of these alignments still redirect fresh water away from entering the pond after rainstorms. The most evident connection between MC-6 and the pond in the past, however, is the constructed path linking the two. This road is the result of repetitive visits from MC-6 to the pond, and people moving back and forth between the main village and this natural resource.

To test the availability of salt in the past, the pond was cored at a 30 m interval along its full length in 2010. A piston corer, consisting of a 3-inch-diameter, 4-feet-long Lexan polycarbonate tube with a vacuum breaker (Fisher, Brenner, and Reddy 1992), extracted the soils without disturbing them. Each core was described and stratigraphic differences based on texture, colour, and inclusions were noted. These cores revealed the pond's unstable and dynamic past, including different depositional environments at various locations. The deepest deposits occurred in the southern part of the pond, the area that is in closest proximity to MC-6. A core from this area was sieved through 1 mm, 600 μm and 250 μm mesh for more detailed description and, more specifically, to collect possible charcoal.

The deposits in the southern part of the pond consisted of a clay and silt layer of 5 cm, including decomposing organic materials (Figure 4). This upper layer was followed by silt deposits with little shell, between 5 and 11 cm. The subsequent layer, between 11 and 14 cm, was similar to the previous layer but for a few small sand particles distributed throughout. At 14 cm, a transition occurred to fine sand, which continued to 17 cm. At this depth, a strong transition occurred again, this one to coarse sand and large amounts of shell. At 21 cm, fine sand, with occasional silt and shell deposits, were identified. Between 27 and 29 cm, the deposits consisted of coarse sand and small rocks, including small shell. Silt, and small stones, were identified between 29 and 33 cm, followed by 4 cm of silt. Between 37 and 40 cm, a layer of fine sand with little shell was found, followed by 4 cm of sand with little shell. After 2 cm of fine sand and silt with shell, a final layer of coarse sand with rocks and shell concluded the core at 51 cm. No charcoal was identfied in any of the layers.

These deposits and differences in texture are directly related to the environmental circumstances in which they were deposited. Smaller particles, such as silt and clay, can only be deposited in slow moving or standing water, otherwise these particles remain in suspension and are transported elsewhere. Conversely, larger particles, such as coarse sand, settle at higher water velocities. By comparing the different textures

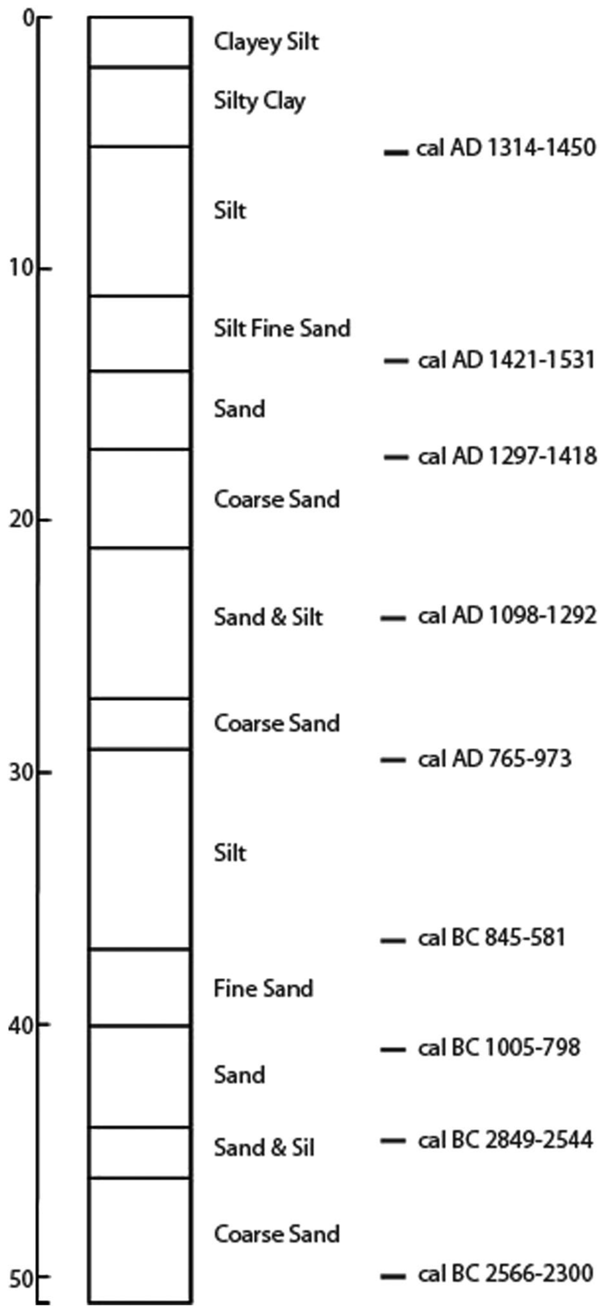

Figure 4. Profile of core from Armstrong Pond depicting different sediments with associated radiocarbon dates.

in stratigraphic sequences, different depositional environments can be inferred (e.g. Curtis, Brenner, and Hodell 2001; Higuera-Gundy et al. 1999; Kjellmark 1996).

The clay and silt deposit that covers the pond for the top 5 cm reflects the contemporary condition of what has become an enclosed pond whose water inflow is limited to precipitation through bedrock and the occasional rain. On the other hand, deposits of coarse sand indicate that the pond was not always closed, but rather that water once flowed through. At Armstrong Pond, flowing water must have come from the Caicos Bank, implying that the pond was once part of or occasionally connected to the bank. A possible relic channel connecting the sandy beach in the southwest direction to the Caicos Bank might have provided the passage of seawater into the pond.

This has important repercussions, as natural salt production through evaporation is only possible in circumstances where evaporation is significantly higher than the influx of new water. Even in the current situation, where influx of new water is restricted, natural salt production is restricted to April to early May and July to August. When new water is added to this delicate ecosystem during the rainy season, the formation of salt crystals is immediately halted. If fresh seawater of a lower salinity level would constantly enter the pond, then no salt crystals could ever form. In other words, salt production is only likely during episodes of silt and clay deposition, and not during episodes where sand is deposited.

X-ray diffraction analysis of the two silt layers confirmed that salt production was likely when these deposits accumulated. Samples of 5 g were powdered, sieved through 63 μm and analyzed at the Department of Geological Sciences at the University of Florida using a Rigaku Ultima IV for general x-ray diffraction. Both silt deposits were 100 percent calcite. The calcite build-up likely occurred as the result of evaporation, as calcium carbonate is less soluble than salt and solidifies as calcite before salt crystals are formed. In fact, calcite deposits are often found in association with salt ponds (Sanz, Zarza, and Calvo 1995). The two layers of calcite deposit, therefore, highlight periods where naturally-produced salt was available in Armstrong Pond, and therefore available to the inhabitants of MC-6.

Nine samples of shell from different contexts, including the two silt layers, were collected, analyzed by AMS, and corrected for the marine reservoir effect using CALIB REV6.0.0 (Stuiver and Reimer 1993). This resulted in a clear chronology of different environmental conditions at the pond. The dates recovered from the deepest silt layer were cal. BC 845–581 and cal AD 765–973, indicating a long-term episode of relative stability and natural salt production. Superimposing layers denote an open environment with flowing water, likely halting the production of salt, with a latest date of cal AD 1297–1418. The layer consisting of silt and fine sand indicates a transition again to more favourable conditions for salt production and is dated at cal AD 1424–1534. The most recent silt layer has one date, cal AD 1314–1450, and defines the transition to current conditions, and denotes the timeframe when salt was naturally available at the pond.

Table 2. Faunal analysis of classes identified at MC-6, 2010 field season.

Class	NISP	Weight (in grams)	MNI
Mammalia	6	6.12	2
Aves	64	11.47	12
Reptilia	200	123.54	18
Actinopterygii	4365	433.19	167

Fish

Salt was not the only resource exploited at MC-6. Faunal analysis of zooarchaeological samples from the site revealed a distinct pattern of faunal abundance and butchering at the site, suggesting a specialised maritime economy. Notably, fish (Acintopterygii) comprised 94% of the total vertebrae faunal assemblage based on NISP ($n = 4365$, Table 2). In addition, bonefish (Albulidae) comprised 71% of the assemblage that could be classified beyond Acintopterygii ($n = 1183$) (Morsink 2012; Table 3). Other fish, such as grunts ($n = 144$) and snappers ($n = 124$) were the second and third most common, but are represented in significantly lower quantities. Although taphonomy, and the large size of bonefish otoliths, for example, could partially contribute to the higher quantities of bonefish NISP, this pattern also seems to suggest that this species was specifically targeted.

In addition to his work at the site, Keegan noted a distinct pattern of high quantities of cranial elements of fish, whereas quantities of postcranial elements remained low (Keegan 2007). Although this pattern did not repeat among samples excavated in 2010 (cranial elements were 22%, against 78% postcranial elements), Keegan's interpretation involves the procurement of fish; people at MC-6 may have been consuming the heads of fish and/or transporting the fleshy postcranial portion of fishes to other locations beyond the site. Interestingly, fish heads are, in fact, considered a delicacy in Middle Caicos nowadays.

Cotton

Direct quantifiable evidence for cotton production is scarce, but there are strong indications that this plant was part of the local economy at MC-6. Wild cotton plants still grow in an area of the site originally designated as a second plaza (Sullivan 1981). Excavations yielded no evidence of household-like occupation of the second plaza, and Keegan (2007) argued that this area was utilised as a formal garden. Based on ancillary evidence, this interpretation is supported by an analysis of the soil in this part of the site by the author, which concluded that the soil was enhanced by adding nutrient-rich red clays to the natural substrate and then mixing it with organic materials to increase fertility (Morsink 2012).

Historic evidence from Middle Caicos indicates that Loyalist plantations on the island were specialised in the growing of Sea Island cotton (Kozy 1983), a variation of cotton which was highly valued for its long and soft threads at a quality that was often compared to silk (Yafa 2005). Although grown on Hispaniola as well, the Bahamian archipelago was especially known for its production of this resource. Early historic sources confirm that cotton was a highly prized resource in the precolonial Bahamas, as Columbus was impressed by both the quality and quantity of cotton he received during exchanges in the region (Dunn and Kelley 1989). In fact, Anacoana, the most powerful ruling female on Hispaniola at the time of contact, was specifically appointed as the guardian of a house full of cotton (Keegan 2007). While it remains for future research to unequivocally confirm that cotton was indeed grown at MC-6, the importance, quality, and value of (Sea Island) cotton in precolonial and colonial times make this resource a likely candidate for the product grown in an area east of the main plaza believed to be a formalised garden.

Table 3. Faunal analysis of fish classified beyond Acintopterygii, at MC-6, 2010 field season.

Family	NISP	Weight (in grams)	MNI
Albulidae	1183	171.15	62
Exocoetidae	2	0.07	1
Belonidae	15	0.8	4
Serranidae	19	3.36	7
Carangidae	30	3.29	6
Carangidae/Lutjanidae	7	1.05	0
Lutjanidae	124	19.24	16
Gerreidae	15	1.43	7
Haemulidae	144	11.4	16
Sciaenidae	1	0.16	1
Sparidae	3	1.01	2
Sphyraenidae	34	5.87	10
Labridae	3	2.04	3
Scaridae	64	12.95	19
Acanthuridae	17	2.25	7
Scombridae	1	0.33	1
Ostraciidae	8	0.85	4
Diodontidae	2	0.9	1

Discussion

The Materiality of Salt, Fish, and Cotton

Thus far, this paper has considered which resources were the primary economic foci at MC-6. Key to the catalytic environment approach advocated here is a consideration of why salt, fish and cotton were selected for exploitation and/or cultivation and how engagement with these natural resources led to the emergence of MC-6. First, the material qualities of salt are significant. As a dietary human necessity, a lack of salt can cause significant health issues, and even death (Astrup et al. 1993). Salt also postpones decay and acts as a preservative for foods. Especially in environments where dry and cold locations are absent, such as in the Caribbean, salt provides one of the few possibilities to preserve foods. Environmentally, salt in solid form is not available everywhere in the Caribbean, as natural production only occurs under very specific circumstances. Especially on volcanic Caribbean islands where steep cliffs border the sea, natural salt ponds are rare. Other sources, such as salt mines or natural brine wells, are not very common either.

Second, fish are a main source of protein throughout the Caribbean (Newsom and Wing 2004), and have long been an important part of the human diet throughout the region. Yet the ease of accessibility to fresh fish meat cannot be taken for granted, as access to this valuable source of protein is influenced by proximity to marine or fresh water resources. At MC-6, zooarchaeological evidence from the site shows that fish-based protein was plentiful and easily accessible (from an environmental standpoint) via the fertile Caicos Bank. In contrast, on Hispaniola, while some Taíno villages were located in close proximity to the coast and enjoyed ample access to marine resources and fish (e.g. LeFebvre 2015), many others were located inland in mountainous regions not easily reached from the sea. If fish was the desired source of protein in these locations, it was necessary to import these products to satisfy local inland demands.

Although surrounded by a great diversity of marine fish taxa, people at MC-6 seemed to have targeted bonefish, or at least taken advantage of the bonefish populations associated with the surrounding habitat. Bonefish are a white-meat fish available year-round, but they exhibit seasonal behaviour patterns. Bonefish spawn in April and May and occupy the flats of the Caicos bank in large groups. This congregating behaviour continues throughout June, July and August. However, during the summer months the fish move to deeper offshore waters during the day and return when the water has cooled at the end of the day. The significance of this behaviour in terms of targeted exploitation is that bonefish aggregate in large groups to mate, whereas smaller groups are formed throughout the rest of the year and bonefish are found more sporadically throughout the day on the bank (Morsink 2012). Directing large groups of bonefish into fishing nets is a practice present on the north coast of Haiti and is an effective way of capturing large quantities of this fish (Keegan, personal communication 2011).

The material and environmental qualities of cotton include the ability to utilise the cotton fibres to create threads and convert them into a fabric or rope, such as fishing nets. Furthermore, cotton plants are salt-tolerant plants (Yafa 2005), making them an ideal crop plant in a salty-air marine environment like that of Middle Caicos. Equally important, cotton plants require very little precipitation to grow (Yafa 2005). In fact, precipitation is only needed for germination and initial growth and subsequent rains deteriorate the quality of cotton after they open. Locations subject to constant sea spray and little precipitation provide problematic conditions to grow a wide variety of plant resources, but are optimal locations to grow cotton. The apparent enhancement of the soil associated with the second plaza coupled with the environmental conditions of MC-6 would have provided opportunities to cultivate cotton on a large scale.

An Economy of Salt, Fish, and Cotton

The materiality of salt, fish, and cotton were interdependent parts of an integrated economy for people at MC-6 and provide key suggestions as to how these products were entangled and interwoven, shaping MC-6's local economy. Salt's preservative quality, for example, may have affected the exploitation, transport, and exchange of fish. With direct access to the Caicos Bank, there was no shortage of marine resources at the site. Inhabitants of MC-6 were aware of this and, I argue, exploited bonefish and other marine resource for reasons beyond local needs. Surveys on the Turks & Caicos Islands have revealed that large villages were rare and the region lacked high population densities (Keegan 1992, 1997; Sullivan 1981). Exploiting resources beyond local needs at MC-6 would have had little local function from a dietary perspective, as the market was small and people in other villages in the Turks & Caicos Islands had access to the same resources. Yet, with salt, fish could be preserved and transported to larger and more distant locations, such as Hispaniola. In this scenario, the local fishing economy would have been implicated in larger trans-archipelago economic networks.

In terms of bonefish, the local fishing economy of MC-6 may have articulated with Hispaniola economies on a seasonal basis. Bonefish offer important qualities to people fishing with the export of salted fish in mind. Bonefish are a white-meat fish, meaning the majority of lipids are located on the liver (Murchie, Cooke, and Danylchuk 2010) versus 'oily' fish, such as salmon, where lipids are located throughout the body. Lipids can spoil the fish after salting, so the leaner the fish, the better for salting. The spawning behaviour of bonefish also accommodates targeted exploitation of this resource because the fish is easier to catch when it aggregates in large groups on the Caicos Bank.

If net fishing was indeed practiced at MC-6 to catch bonefish, then cotton would have been an excellent source to produce the nets for capture. It is difficult to test if the inhabitants of MC-6 locally manufactured fishing nets from the cotton produced at the site, but this example shows that the exploitation of salt, bonefish, and cotton would have been an opportune exercise of effort, ecological knowledge, and social cooperation among the site's inhabitants. The exploitation of salt, bonefish, and cotton can be characterised as self-reinforcing; as individual resources they are valuable, but the combination of them exponentially increases their potential in terms of output. Fresh fish only lasts a maximum of two weeks in the Caribbean climate before it spoils, but salted fish can be easily kept for a year (Caribbean Commission 1952). Salt and cotton nets allowed people to catch fish in high quantities, accumulate and store them for extended periods of time, and export them in bulk quantity without the threat of decay and loss.

I argue that this economic triangle of mutually interdependent and entangled resources available at MC-6 demonstrates how social knowledge was invested in the selection of certain resources over others at this site. Other staples, such as corn or manioc, might not have been as important at MC-6 as at other sites in the Caribbean archipelago, and Keegan (2007) emphasises that NISP of mollusk species is lower than other sites in the region. The environment provided the natural conditions for the exploitation of salt, fish, and cotton, but the materiality of these resources and the social knowledge invested in them fostered a complex web of interacting entities of environments, material resources, and people.

The Temporality of Production at MC-6

As is the case today, the temporality of production and associated products was a significant factor in the decision-making processes of people in the past. The concept of temporality involves the social construction of time through practices, such as fishing, harvesting, or planting, and how people experience time connecting the past, the present, and the future. The act of fishing, for example, is temporally connected to past practices of fishing and based on experience, but, at the same time, is focussed on future practices of consumption and possibly export of salted fish. Furthermore, temporality also incorporates how these practices are linked with each other in chronological and social orders (Gosden 1994; Ingold 2000, 2012; Thomas 1996). As discussed previously, salt is naturally available at Armstrong Pond during April, May, July and August and bonefish populate the flats of the Caicos Bank from April to August. The bonefish season falls at exactly the same time of year that salt was naturally producing at the pond. Therefore, from April to August, I assert that people were collectively engaged in the production of salt and fish to prepare salted fish for export.

Further, seasonal activities for cotton production follow a specific yearly cycle as well. Cotton needs water to germinate, which is limited to the rainy season around May. This means that the garden needed to be prepared and tilled and cotton seeds needed to be planted ahead of the rains in May. If not, the entire harvest was jeopardised. Subsequently, the cotton plant would grow in May and June, cotton balls would open in July and mature in August. In September, the cotton was ready for harvest. If nets were used to catch fish, the making of nets needed to happen in between harvest and the next fishing season in April and May.

These seasonal activities at MC-6 are cyclical and span multiple years, creating a continuous rhythm of entangled practices that fit neatly together in a yearly cycle of economic production (Morsink 2012). In February, the inhabitants of MC-6 would have started to prepare the gardens and plant the seeds for cotton production. In April, they would have shifted to salt production and fishing. During the rainy season, which lasts from May to June, attention would have been focussed on fishing with large quantities of bonefish available on the flats. When the rains stopped June, and salt production picked up again in July, people would have directed their attention back to Armstrong Pond. In September, when salt production halted, and bonefish were more difficult to catch, cotton would have been harvested. The time between the cotton harvest in September and the preparation of the gardens in February was not idle, as this was the ideal time for long-distance voyaging outside the hurricane season. The temporality of these products created a calendar of yearly economic practices, and this calendar was strictly observed to plan the exploitation of these resources.

The importance of these seasonal changes and yearly cycles is materialised in the architecture of MC-6 (Morsink 2012). The stone alignments on the plaza of MC-6 point to specific rising and setting locations of important stars, such as the Sun during its solstices, and Sirius and Betelgeuse as part of Orion (Sullivan 1981). These stars, too, have yearly cycles. For example, Orion is well-known in Caribbean and South American cosmology, as it disappears from the night sky during May and June, and is thus considered a reliable marker of the rainy season (Keegan 2007). The seasonal patterns of the stars referenced at MC-6's plaza coincide with important changes in economic practices related to the production of salt, fish, and cotton (Morsink 2012). The astronomical alignments on the main plaza are, therefore, a tool to observe the stars and anticipate seasonal changes in weather patterns that affect and influence the production of natural resources that were the basis for its local economy. MC-6 architecture is a calendar that people used to track time.

MC-6 had an ideal combination of environmental parameters that allowed for the exploitation of high-quality resources that were, presumably, in demand in other places, such as Hispaniola. The presence of imported pottery from Hispaniola at MC-6 confirms that those groups interacted closely with each other (Keegan 2007). The exploitation of salt, fish, and cotton resources reinforced each other and created a network of interdependent products. In addition, these resources could be exploited in a structured yearly cycle, where each economic resource did not interfere with the production of the other. In other words, these resources were compatible in a temporal sense, and allowed people to pay full attention to each resource when they were temporarily available.

The Catalytic Environment of MC-6

From AD 700, people visited Turks & Caicos Islands and were exposed to the natural environment of these places. Natural salt ponds, local fauna, and the Caicos Bank must have been explored during the centuries of repeated travels from Hispaniola and back. These experiences contributed to a social understanding of what these environments were like, what resources were abundant, and how these resources could potentially be marketed on Hispaniola. These first steps of colonisation were trial and error, and provided people with the social knowledge to efficiently exploit the resources on these islands that were in demand on Hispaniola.

During this time of repeated visits, between AD 700 and 1300, there is evidence of occasional short-term visits to MC-6's environment (Keegan 2007; Sullivan 1981). Yet, when people started to establish year-round villages on Middle Caicos and other islands in the region, MC-6 was not considered. Likely, people did not consider the environment of this site, and the available resources in its vicinity, suitable for year-round exploitation. During this time, Armstrong Pond was an open environment and salt was not naturally present during the summer.

This interaction between environmental opportunities and people's goals is particularly highlighted by the fact that people founded MC-6 at the moment that Armstrong Pond was formed. People were aware of the environment of MC-6, but without access to a salt-producing pond, did not consider living there. With access to large quantities of high-quality salt, however, the local environment was considered suitable. In fact, the rapid construction of the site, as evidence by the short period it took to build the midden, seems to suggest that people were rapidly investing a significant amount of energy in this village. The Caicos Bank and the local climate were always conducive for fishing and cotton-growing practices, but with the addition of salt, this locale attracted people's attention to the site's production/economic potential.

The elaborate structure of the site – with middens, a central plaza with celestial alignments, an indigenous road, and stone structures – can be seen as a materialisation of the success of the village. MC-6 is the result of people being aware of the potential of their environment, its natural resources, and how these resources can be used in social relations, such as exchange networks. This is a crucial aspect of catalytic environments. People are aware of their surroundings and are knowledgeable about how certain resources provide economic and social opportunities. The interaction is not between nature and culture, but rather a complex network of material qualities of resources, people, and socially constructed networks of exchange. The formation of salt crystals after the formation of Armstrong Pond induced a change in people's perception of that environment, which now became suitable for year-round habitation. Without this natural change, people would probably have continued to visit the area, but other areas would have been selected as suitable for establishing villages.

Salt acted as a catalyser. The decision to move to MC-6, start a new village, and initiate an economic cycle based on the exploitation of salt, fish, and cotton, was fuelled by the formation of salt crystals along the bank of the newly formed Armstrong Pond. Access to dry land, suitable for cotton production, and the Caicos Bank, was always available at the area of MC-6, but it was only after the formation of salt crystals at Armstrong Pond that this location was perceived desirable. Although salt affected these decision-making protocols, salt never took part as an active and determining participant in these processes. People who were aware of their lived-in world saw the new opportunities and acted upon them. Their perception of the world, which included social relations on Hispaniola, understanding economic demands on that island, and natural availability of resources that could potentially be traded, formed a context in which the presence of salt initiated a chain of events. Without salt, people would likely have elected other locations, other practices, and maybe even other trade networks. Yet, throughout the history of these processes and the multiple ways salt was affecting social relations at MC-6, physical properties of salt produced at Armstrong Pond never changed.

Concluding Thoughts

I suggest that understanding the relationship between natural resources and people through the metaphor of a catalyser adequately accentuates the key role of the environment without superseding the significance of human agency. This approach highlights the active contribution natural environments make to changes in social relations through the absence or presence of specific resources. The context in which these resources start to function as a catalyser is dependent upon how people use these products and their material qualities in social networks. Although natural resources play an active role in these processes of change, it starts and ends with people consciously interacting with these resources and utilising them in exchange relations.

This paper applies to the Caribbean, specifically, as its highly diverse landscape serves to magnify the interplay between environments, local histories, and social developments. At the same time, other environmental factors connected people through networks of exchange and, in turn, created *regional* histories, such as the sea as a facilitator of transportation, and island-specific resources which induced markets of demand and supply. Although the scope of this paper is limited to a Caribbean application, this perspective, characterising local environments as catalysers, can be applied to a variety of situations. The concept of catalytic environments is a tool relevant to any context where natural factors influenced decision-making processes. As such, catalytic environments highlight the importance of specific local events, while maintaining a generality to be universally applicable.

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Joost Morsinkhas over 15 years of experience with archaeology and worked incultural resource management in the Netherlands, the Caribbean, and the United States. His academic education derives from two international programs, including Leiden University, the Netherlands, and the University of Florida. He is a Fulbright Alumn and recieved a NSF dissertation improvement grant for his research in the Turks & Caicos Islands.

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