Andean Archaeology and Ethnohistory - Anthro 326: Class 7

Seafood and the origins of farming

- Chronology
  - Moseley is confusing about chronology in part because the reality is confusing
  - things happened at different times at different places, making it difficult to create consistent, useful periods
  - that is why Moseley gives so many dates for sites and events
  - try plotting them on the chronology chart handout as a way of taking notes while you read

- Moseley's chronological terms in the textbook (adjusted to calibrated dates):
  - note that in this chapter, he switches from BP to BC dates
  - Lithic period
    - up to about 3,800 cal BC
      - (Moseley gives this as 5,000 BC uncalibrated, equivalent to 3780 cal BC, but this is a very round date, anyway)
    - the tapering-off of the Pleistocene
  - Preceramic period:
    - about 3,800 cal BC to roughly 2,200 cal BC
      - (recently cited as ending around 1,800 BC uncalibrated, equivalent to 2170 cal BC, but again, this does not date any precise, specific event)
    - the first 1,600 years of stable modern climate, sea level, ecological zones
    - since sea level had stopped rising, preceramic sites have not been covered by the sea, as earlier sites near the shore would have been
      - so the evidence is more complete
  - Late Preceramic period, also called the Cotton Preceramic period
    - the later part of the Preceramic
    - about 3,200-2,200 cal BC

- An alternative way of dividing up time that you may see in some sources
  - in radiocarbon years, these periods are divided at round 2000 year intervals
  - Paleoindian period: first arrival of people up to about 9,500 cal BC
  - Early Archaic period: 9,500 cal BC to 6,900 cal BC
  - Middle Archaic period: 6,900 cal BC to 4,800 cal BC
  - Late Archaic period: 4,800 cal BC to 2,000 cal BC

- A big issue in the later Lithic period and the Preceramic is how people got their food, and how that changed over time
  - more specifically, how and why people started adding farming (agriculture) to the foraging, hunting, and fishing adaptations that we saw last time
  - this is important for several reasons
    - first, virtually all modern societies are based directly or indirectly on agriculture
      - so the transition to agriculture seems important in itself

- second, as we will see, Preceramic people and their descendents built some very large structures and may have had fairly complex societies
  - so we want to know how they supported all that impressive activity

- How can we tell when people grew their own plant foods, as opposed to collecting wild plant foods?
  - finding fields, canals, etc.
    - requires exceptionally good preservation, lack of later disturbance, and luck to find this rare evidence
    - also, we expect to see this sort of evidence only after farming has become fairly well developed and widespread, probably not at the early stages
      - because early canals, etc. would be small and simple, so less likely preserved or detectable
      - because the earliest canals, etc. would be few; they would become more common (and more likely to be found) later
  - finding remains of domesticated plants
    - or, if we are interested in herding, finding remains of domesticated animals
    - OK, so how do we recognized domesticated plants or animals, as opposed to wild ones?
      - Domestication means genetic modification of the plant or animal population through human intervention in their survival and reproduction (intentional or not)
        - removing certain plants or animals in order to eat them leaves a selected subset to reproduce
          - the next generation is more like that subset that was not eaten
        - planting seeds or bringing animals together to mate means that humans are selecting which ones will reproduce
          - again, the next generation will have more of the traits of the selected subset
      - so recognizing domestication means distinguishing plant or animal varieties that are unlike the wild forms, ideally intermediate between wild and known domesticated forms

- Some of the major plants domesticated in South America (a partial list)
  - maize (corn) became very important in the Andes, but was probably domesticated in Central America, not South America
  - "pseudocereals": quinoa, amaranth
  - beans: common bean, lima bean, jack bean
  - roots and tubers: potato, sweet potato, yuca (manioc), jicama, oca, ulluco, achira (a rhizome), etc.
  - various squashes
  - peanut
  - chili pepper
  - tree fruits: guava, papaya, pineapple, chirimoya, avocado, lucuma, pacay
  - "industrial" crops
    - cotton (for fishing line and nets, possibly domesticated in tropical Ecuador or northernmost coastal Peru)
    - gourd (for making containers, floats, etc.)

- medicinal domesticates: coca, tobacco

- The major domesticated animals of Andean South America:
  - camelids: llama, alpaca
  - guinea pig (*cuy*)
  - dog

- von Humboldt's theory of why/how domestication happened, Moseley's version:
  - as human populations grow, people are pushed into less favorable environments
    - in the Andes, that generally means higher-elevation areas
  - the plants and animals they know and like are scarcer or absent in these areas
  - so people help familiar food plants to grow in these areas beyond their natural ranges
    - by diverting water to them, weeding, tilling the soil, planting seeds, etc.
  - this has the effect of selecting for certain characteristics, intentionally or not

- The process and evidence of domestication
  - we will look only at South America here
    - different plants, processes, and dates of domestication in North and Central America
    - some of these may be related to South America (especially the domestication of maize in Central America), but we won't go into that
  - the general pattern in the Andes:
    - there was no single "agricultural revolution"
    - instead, different plants and animals were first domesticated in different areas, at different times, and they were adopted in other places in an irregular, slow pattern
      - at first each plant just added a little bit to a fishing, hunting, and/or foraging lifestyle
      - some gradually became more important to the diet and were joined by additional domesticates as time went by
      - in different places, domesticates were adopted in different orders at different times
    - we will look at just a few examples
      - there are many tens, if not hundreds of sites that have the oldest example or this or that domesticated plant in this or that area
      - spanning the range from around 9,500 cal BC to around 800 cal BC
      - Info on plants and dates here is from Deborah Pearsall 1992, The Origins of Plant Cultivation in South America, in Cowan and Watson (eds) The Origins of Agriculture
        - this differs from Moseley; I am not sure why
        - but I suspect that Pearsall, an expert in plants in the Andes, is more authoritative on this subject
        - I have calibrated all the dates from Pearsall, since the dates she gives for sites that I know from other sources appear to not be calibrated
      - don't worry about learning all the dates; get the general pattern, rough date range of the whole process, and maybe a few dates for plants that seem interesting to use as examples
  - highland sites with early evidence of plant tending
    - Guitarrero Cave, highlands of Peru

- oldest definite cultivated plants in the New World
- mostly wild plants used for fiber mats and net bags, some wood fire-drills and weapon hafts
- cultivated plants in the layers dating to 9,500-8,700 cal BC:
  - oca (a tuber)
  - bean, lima bean
  - chile pepper
  - lucuma (a fruit)
- how do we know these were cultivated?
  - they are not native to the area
  - so they were probably grown by people and were probably becoming domesticated
- this suggests that people may have encouraged (and domesticated) local plants, too - but we can't recognize this because they would have been growing there, anyway
- Moseley also mentions ulluco (a tuber), pacay (a tree fruit), and rhizomes (edible roots)

- Tres Ventanas Cave, headwaters of the Chilca valley, central highlands of Peru
  - 6 dates, from 9,500 to 5,300 cal BC
  - Pearsall associates various tubers with the earliest date (9,500 cal BC):
    - potato, sweet potato, ulluco, jicama, yuca (manioc)
- Ayacucho area caves
  - 6,600-5,300 cal BC
    - industrial: gourds
    - staple: quinoa, squash
    - Moseley dates these caves to 9,500 cal BC (?)
  - 5,300-3,900 cal BC
    - staple: beans, potato
    - "condiment": lucuma (a tree fruit)
    - medicinal: coca
  - 3,900-2,100 cal BC
    - industrial: cotton
    - staple: achira (an edible rhizome, or root)
    - "condiment": chili peppers

- coastal sites with early evidence of plant tending
  - Chilca caves, central coast of Peru, near lomas
    - near mouth of the same river that Tres Ventanas Cave is on
    - may be as old as Guitarrero cave and Tres Ventanas cave, but may also be a bit more recent
    - 9,500-6,900 cal BC
      - the same tubers as at Tres Ventanas: potato, sweet potato, ulluco, jicama, yuca (manioc)
  - Las Vegas, coastal Ecuador (as we saw last time)
    - bottle gourd by 9,700 cal BC?
      - observed as a circular discoloration in the soil, poorly preserved
      - Pearsall is not convinced

- primitive maize phytoliths by 6,900-5,400 cal BC
- But at all these places, tending plants and herding animals remained only part of a mixed subsistence base including foraging and hunting for many thousands of years...

- On the coast of Peru and Chile, most preceramic people were apparently content to stick mainly with fishing and foraging
  - the sea was so rich that they didn't have to bother doing more than minimal tending of "industrial" plants and some minor foods
  - 6,900-4,810 cal BC: gourds on north coast of Peru
  - 5,100-3,200 cal BC: various plants on central coast of Peru
    - industrial: cotton, gourds
    - staple: bean, lima bean, squash
    - "condiment": chili peppers, guava
  - Coastal fishing villages (with some plant gathering and tending)
    - Paloma: 5,900-3,300 cal BC
      - In Moseley's chronology, this is the last bit of the Lithic period and the first bit of the Preceramic period
      - Description of Paloma
        - located up the coast from the mouth of the Chilca river
          - near areas of lomas vegetation
        - water from nearby spring, or pits? or wells?
        - village of reed huts with mat floors
        - storage(?) pits, some later ones lined with grass
        - hearths
          - small ones inside huts, maybe for light
          - larger ones outside, for cooking
        - simple technology, with grinding tools, net bags
        - separate garbage dump
        - population estimated by number of huts and grinding stones: two to ten families at a time?? Maybe higher?
      - Paloma subsistence
        - Mostly seafood, some lomas plants
          - some small animals
          - many wild plants, including ones gathered from the nearby valley and from the lomas
          - small amounts of beans, squash, gourds, and guavas, either tended or traded for with people living along the river
          - preponderance of fish and shellfish is based on garbage, coprolites (dried human feces), stomach contents of burials, bone chemistry…
        - 36 depressed areas might have been sunken gardens
          - sunken garden: dig a broad area down to where the soil is damp, plant crops there
          - not dated, so they could have been made by later users of the area
        - Moseley points out that even fishers need land plants, either collected wild or tended
          - cotton for fishing lines and nets

    - gourds for net floats and containers
    - reeds for boats, house construction, etc.
  - Year-round occupation was possible
  - But contact with distant people, or travel, is also indicated
    - Cacti from one or two days' walk away
    - Obsidian from 400 km away
    - *Spondylus* shell from Ecuador ("spiny oyster" with red lip, prized for ornaments, later used in ceremonial contexts)
- Nearby, next to the river floodplain, was another village: Chilca I
  - probably occupied at the same time as La Paloma
  - but continued a little longer, after Paloma was abandoned
  - 4,500-3,000 cal BC (dates calibrated from Pearsall 1992)
  - location by floodplain was better for tending plants
  - not surprisingly, a wider variety of food plants than at Paloma:
  - various beans, squash, jicama (a tuber), achira (an edible root), caygua (something like a bland green bell pepper)
- Another coastal preceramic fishing village: Huaca Prieta
  - Chicama valley (coast north of Moche valley)
  - 3,000-1,400 cal BC
  - relatively large for a Preceramic village, occupied for many centuries
  - Built up a mound of shell, ash, plant material from decomposing abandoned houses, etc.
    - name means "Black mound", describing the soil, rich in charcoal from cooking fires
  - subsistence:
    - mostly fish (net-fishing from simple boats) and shellfish
    - but also collected beans, squash, achira (an edible root), chili peppers, and wild fruits
    - i.e. fishers and foragers, but did not farm much or at all
    - also gathered "industrial" plants: gourds, plants for fiber mats, cotton and other plant fibers for nets, cordage, etc.
  - simple technology and crafts
    - hand-knotted textiles, extremely labor intensive
    - example: pyroengraved gourd container
  - comparable to Native Americans along the California coast and San Francisco bay
- Far to the south, the Chinchorro tradition
  - roughly 7000-1000 cal BC
  - maritime specialists, with some gathering and tending of plants
  - dry climate has preserved their equipment well
  - nets, lines, fishhooks
  - harpoons used with spearthrowers for very large fish, sea mammals, probably from boats
  - shellfish collecting, including both shoreline collecting and probably diving
  - this is the group that made the mummies we saw last time

- around the beginning of the Late Preceramic (3200 cal BC), some coastal societies started building large, non-residential structures
  - Aspero
    - a large coastal fishing village at the edge of the marsh at the mouth of the Supe river
    - unknown when it was first occupied
    - accumulated numerous shellmounds, similar to Huaca Prieta
    - began fixing up shell mounds with stone facing and non-residential wall complexes on top, adding material to make them higher
      - these were clearly ceremonial places
      - this building tradition already established by 3,000 cal BC
        - must have started earlier, guess at 3,200 cal BC
      - comparisons:
        - first small temple mound in Sumer (Mesopotamia) about 4,500 cal BC
        - first mastaba tomb in Egypt: about 3,600 cal BC
        - first pyramid in Egypt: about 2,700 cal BC
  - Caral
    - a large complex of stone-faced mounds with non-residential wall complexes on top, entirely artificial construction
      - with some hundreds, maybe a few thousand, people living in and near the complex
    - located 23 km from the mouth of the same valley where Aspero is (5 hours' brisk walk from the coast)
    - currently looks slightly later than Aspero, starting 2,700 cal BC, lasting to 2,000 cal BC
      - but more work is needed to nail down their relationships in time, economically, politically, etc.
  - We will look more at what these were like, and what sorts of societies might have built and used them, next time
  - the question now is, what subsistence base supported these early, large-scale collective projects?
    - we usually assume that foragers either can't manage this sort of thing, or don't feel any need to

- Moseley's "Maritime Foundations of Andean Civilization" (MFAC) hypothesis
  - complex societies in the Old World that built impressive monuments were all based on agriculture
  - but agriculture may not be the only possible basis for development of complex societies
  - specifically, very early large monuments and social complexity on the coast of Peru were supported by an economy that depended heavily on fish and shellfish, with some farming for industrial crops and minor foods
  - MFAC as summarized by Moseley in the text, pg. 110:
    - rich marine resources provided a basis for a “neolithic revolution” comparable to that associated with farming in the Old World, supporting
      - sedentism
      - population growth
      - formation of large communities

- many people in frequent contact, a "critical mass" of interactions
- development of complex societies
- building large monuments (our focus next time)

- support for the MFAC hypothesis
  - large preceramic monuments were built precisely in the areas with richest fisheries, suggesting a causal relationship
- summary of the development of early subsistence economies on the coast, slanted the way a proponent of MFAC would see it:
  - first, mobile foragers using game and wild plants
    - low population density, small groups, mobile
  - by late Lithic period, they used more marine resources
    - especially shellfish
    - not very seasonal, so they allow permanent settlement (sedentism)
    - increasing use of rich marine resources fed continuing population growth
    - population grew until seafood was not a supplement to other gathered foods, but a requirement
      - they were "locked in" to the marine subsistence base in the same way the people who take up farming eventually are "locked in" to agriculture
  - Late preceramic period (also called "cotton preceramic") 3200–2200 cal BC
    - as population grew beyond what the most easily accessible marine foods could support, they elaborated their fishing technology
      - this required intensive gathering, and eventually tending, of "industrial" plants
      - cotton: the first crop grown in sizable amounts, and the most important for a long time; needed for fishing lines and nets
      - gourd for net floats and containers
      - hence this period is sometimes called the “Cotton Preceramic”, 3200–2200 cal BC
    - only minor food crops, since marine resources were easier
    - little organization was needed for this economy
    - population got very large at some individual sites, and in some regions that had numerous smaller sites
    - this mixed economy of maritime resources and minor farming supported early developments such as
      - craft production
        - bone, stonework, woodwork, gourd pyroengraving
        - baked clay figurines, spindle whorls, etc. presaged ceramics, which were not yet used
        - twined (not woven) textiles
      - some variability in mortuary treatment
        - we'll look at this next time
        - suggesting some minor differences in social statuses
        - mostly by sex and age
        - but also some variation within these groups, especially among adult males: incipient leaders or aristocracy?
      - monumental architecture

    - we'll look at this next time
    - may have required a large, organized, controlled work force – but maybe not; not everyone agrees
- Initial period, starting about 2200 cal BC
  - pottery came into use
    - Moseley and Burger both suggest that pottery and agriculture often go together - a common claim
    - but parts of the Andes may be exceptions
    - in my work on the far south coast
      - large sites located well inland, where no sane fisher would live
      - with garbage full of domesticated plant remains
      - at least one dating over 1000 years before the first pottery in the region
    - Caral is a similar example
      - it is too far inland for a large number of people to live permanently without farming
      - but was occupied and had big ceremonial mounds many centuries before they started using pottery
  - farming replaced fishing as the main subsistence resource
    - (again, this is a generalization; it apparently happened before the Initial period in some places)
    - requires building canal systems to irrigate more area outside floodplain
    - the important shift in the Andes was not the *invention* of agriculture, or even its *adoption* as a sideline, but the *commitment* to it after millennia of incidental farming
  - Moseley suggests that Preceramic people were "preadapted" to develop irrigated farming, so they could make the change rapidly
    - they already had the material and social know-how to farm
      - fishing had long required them to tend industrial crops (cotton, gourds, reeds) for lines, nets, floats, boats
      - and they had long tended minor staple foods for carbohydrates (tubers, beans, squashes)
      - and "condiment" crops (chili peppers, fruits)
    - they could free up labor for building canals and preparing fields because the maritime economy was so productive
    - they already had the corporate authority needed to motivate and coordinate group work like canal building
      - to many people, this authority is implied by the monumental architecture
        - Burger disagrees, as we will see next time
      - many assume that some corporate authority is needed to
        - mobilize labor and direct canal construction
        - to organize maintenance work
        - and to adjudicate water distribution so that the system could function without breaking up
      - although some ethnohistorians argue that just before the Spanish conquest, such projects were managed by cooperating families and villages without any corporate authority

        - but we don't know if they were originally built without it, or if this was a recent change due to plagues, etc.
    - some fishing settlements continued, but new, large settlements appeared inland in the river valleys
        - where they must have focussed on agriculture
        - and where they built ever larger ceremonial structures
    - hypothesis:
        - some form of authority developed along with earlier Preceramic monuments
        - this authority organized canal construction and use
        - that immediately gave them some control over the new agricultural means of production
        - hence access to food for staple finance
        - and also power over farmers who depended on the canal water
        - so the shift to irrigated agriculture could thus have been a big kick up in social complexity and the power of political/religious institutions
    - since fishers and farmers had to live in different places, two distinct social groups developed
        - with large-scale trading of food between them
        - probably contributing to increasing specialization and differences in social roles, wealth, and status
- Moseley has adjusted MFAC since he first formulated it in 1975
    - Originally, it was pretty overstated, strongly stressing fish and shellfish almost to the exclusion of other foods
        - this was based on preliminary inspection of early sites, which are full of fish bone and shell
    - MFAC inspired a lot of research, which applied better methods and found that wild and cultivated plants were also present at these sites
    - Moseley has adjusted MFAC to take these findings into account
    - the modern version of MFAC emphasizes
        - an extremely productive *combined* resource base
            - seafood for protein
            - cultivated plants for carbohydrates
        - that required and encouraged a complex division of labor and economy
            - specialized fishers vs. specialized farmers
            - large-scale transportation and exchange of food between them
        - this productive, complex economy was made possible by the earlier mostly maritime adaptation
            - which "preadapted" or equipped people for a rapid shift to committed farming
        - this is still different from standard Old World "neolithic revolution" models
            - in which seafood plays no role
            - and in which specialization and exchange are separate developments with different causes, not inherent parts of the commitment to agriculture
        - in the modern version of MFAC, seafood was crucial both to the development process and the mixed resource base that resulted, but was not the only resource

  - a similar increase in farming occurred in the mountains at roughly the same time
    - as people focussed more on casual farming, population shifted from the high puna to bottomlands of sierra valleys where plants grew more easily
    - although they did build ceremonial structures, they seem to have been conglomerations of individual projects built by separate families for small-group use, not planned ceremonial centers serving large groups
      - As at Kotosh, which we will look at next time
      - probably remained simpler, village-level societies
    - fishing was obviously not part of the process in the highlands…

- The fuss over Caral, in the Supe valley
  - it dates to the Late Preceramic period: about 2,700-2,000 cal BC
  - and it has large monumental architecture (more on that next time)
  - yet its inland location and the remains in garbage there indicate that it was a farming community, dependent on irrigation, not just the naturally-watered floodplain
    - with a lot of seafood obtained either directly or, more likely, by trade with coastal maritime specialists
  - Moseley's MFAC emphasizes that seafood supported Late Preceramic complex societies, with minor (albeit essential) contributions from agriculture
  - Burger's version in today's reading is a bit more fully detailed and balanced, emphasizing the complementary roles of both, but still acknowledges that Late Preceramic complex society probably would not have been possible with the rich sea resources
    - Burger also argues that large monuments may not necessarily imply complex, stratified social organization
  - Pringle says that since Caral is earlier than any comparable "urban" center on the coast, so seafood cannot have been the crucial factor.
    - instead, farming was the basis for large sites and monuments, just as in the rest of the world
    - but: was Caral really "urban" or "complex"? (a subject for next time)
    - was it really "first"?
    - was it really independent of marine resources?
  - Shady Solis, Haas, and Creamer say that
    - this is one of the first places where people shifted from marine foraging to irrigation agriculture
      - but did they really "shift", if they ate so much seafood?
    - this is a very large site with large monuments and presumably complex social organization, unprecedented in scale at this date, with 16 other large, related sites in the same valley
      - so it may be where the pattern of large ceremonial centers first arose
      - do you recognize the *origin-center -> civilization horizon* model?
  - Sandweiss and Moseley reply:
    - Aspero, near the mouth of the Supe valley, is several centuries earlier and has significant monumental architecture

- earliest date about 3,000 cal BC, and it is not on the earliest stage of construction, so building probably started earlier: 3,100 or 3,200 cal BC
- so Caral is not the first such site
- (although it *is* much larger)

- Aspero is on the coast, and people at Aspero got virtually all their protein from the sea
- so marine resources were essential
- and probably supported the beginning of a pattern that later was elaborated at Caral

- recent versions of MFAC emphasize that
- seafood was essential for protein
- plants provided carbohydrates
- it was the *conjunction* of the two that made large, permanent settlements and monumental architecture possible
- My interpretation of their point here:
- the point is that seafood was *essential*
- not that it was the *only* food

- Haas and Creamer reply:
- Caral and the other inland Supe sites are much bigger than Aspero
- [I'm not sure what that proves here, though]

- Aspero might not be earlier than some inland sites, since many are still not dated
- [true, but it is the oldest we know of, until we discover otherwise]

- The settlement and building at Aspero depended on domesticated cotton, gourds, etc. for fishing gear, so agriculture was necessary.
- [This is in agreement with the modern version of MFAC.]

- The marine food at Caral suggests that Caral produced industrial plants for coastal fishers, who in exchange produced seafood for inland farmers, making the coastal developments dependent upon substantial irrigation agriculture
- that is, Aspero did not produce its own crops by small-scale farming on nearby naturally-watered floodplain
- [This may have been true when Caral was flourishing
- but that does not tell us what supported the people at Aspero several centuries earlier
- they could well have raised their own minor crops at that time without irrigation]

- Haas and Creamer see Caral as proving that committed, irrigation agriculture was necessary for urban, complex societies to arise, just as in the rest of the world
- they seem to take this as disproving MFAC

- Moseley and Sandweiss see Caral as confirming that seafood was essential to the process
- they take this as confirming MFAC
- their point is that Pringle, Shady Solis, Haas, and Creamer are attacking an obsolete, simplistic version of MFAC that Moseley and Sandwiess no longer support

- Do you see any resolution here?

- To recap the overall process of the adoption of agriculture:
- plants were mostly domesticated in marginal, inland environments, but played only minor roles in subsistence there for a long time

- they were gradually adopted by fishing people on the coast, particularly cotton and gourds for fishing equipment, and some crops for carbohydrates
- a few settlements became dependent on a mixed system involving large-scale exchange between farmers and marine specialists as early as 2,700 cal BC, as at Caral and Aspero
- in the centuries around 2000 cal BC, many people on the coast and in the coastal valleys made a significant commitment to irrigation agriculture

- which raises the real question: why would fishers commit to farming?
  - population pressure?
    - no evidence that populations were anywhere near the limits of what the sea could support
    - no general pattern of increasing biological stress in burials
    - no shift to less-favored foods that would be expected if the resources were getting used up
  - climate change?
    - plants and animals in garbage are similar to those of today, so people usually conclude that the climate was broadly similar
    - in fact, ice cores and other global climate data indicate a drastically dry, dusty period between about 2,500 and 1,500 cal BC
    - some of my recent work supports the idea that this climate anomaly may have been involved with the adoption of agriculture
      - I looked at the shift to committed farming on the far south coast, very isolated and culturally different from the central coast of Peru
        - it happened at about the same time as on the central coast
      - this would be quite a coincidence if there were not some large-scale process that affected both areas at the same time
        - presumably, the dry, dusty period
        - although why this kind of climate would encourage people to farm is not clear
  - cultural or political reasons?
    - maybe farming was encouraged by elites who were emerging from the process of building Preceramic monuments, in order to further their own ends of production and/or control
      - that is, fishing was hard for elites to control and extract surplus from
      - but farming and irrigation allowed possibilities for control of the product by whoever had rights to the land and/or canals
    - this is Burger's suggestion
    - problem: if so, why did people on the far south coast, who show no signs of emerging elites or monumental architecture, shift to farming at the same time?
  - decline of lomas resources over time, maybe due to some combination of population growth, over-exploitation by people, and climate shifts?
    - declining size of firewood from lomas plants at Paloma suggests that the lomas were being picked clean
    - continued occupation of Chilca I after Paloma was abandoned also suggests decline of lomas resources
      - Chilca I was in the river valley, with access to less fragile vegetation
      - where diverting river water to expand the area of plant growth is relatively easy
      - compared to lomas plants that depend on fog and are far from any water source

  - there is not much you can do to encourage lomas growth
  - decline of lomas may have led to increasing emphasis on tended plants, gradual shift towards more farming
  - maybe this is part of how a dry period could contribute to the commitment to agriculture
- maybe some combination of these factors, or something else…?