Chapter 1: Acquiring and Interpreting Data in Archaeology

# Chapter Summary [Copied from Olszewski 2019, Chapter 1]

* The methods and theories used in archaeology provide a bridge to understanding the past.
* Archaeological research is guided by research designs that organize the research questions and methods within a theoretical framework.
* Context is a key concept in archaeology because it allows us to precisely place cultural materials, animal bone assemblages, activities, sites, and many other data sets both temporally and spatially. Archaeologists record context in 3D space (*x*, *y*, and *z* coordinates) using technologies such as GPS and total stations.
* Understanding site taphonomy, which is the set of natural and cultural processes that occur during site formation, is critical to developing accurate interpretations of past activities.
* Archaeology is multidisciplinary, and researchers work with specialists in fields such as geology, palynology, bioarchaeology, paleoanthropology, ancient texts, archaeometallurgy, and zooarchaeology, among many others.
* Sites and the materials they contain can be dated with one or more techniques. Relative dating methods include stratigraphy and seriation. Absolute dating methods include calendars and other written records, dendrochronology, radiocarbon, archaeomagnetism, thermoluminescence, optically stimulated luminescence, paleomagnetism, and potassium–argon.
* Archaeologists often use theories originally developed in other disciplines such as biology, ecology, social sciences, and the humanities. Examples of theories include Darwinian archaeology, gender archaeology, human behavioral ecology, agency, ecological archaeology, niche construction, landscape archaeology, ecodynamics, and networks and boundaries. Some of these theories are sometimes grouped into either processual or postprocessual archaeology. Processual archaeology uses scientific method, whereas postprocessual archaeology stresses the influence of the actions and ideas of past peoples on their behaviors.
* The archaeological record represents the cultural heritage of all peoples, past and present. Cultural heritage can be used in many ways, including telling the story of the past history and prehistory of particular groups of people or nations, as well as for tourism. Although there are international agreements plus many cultural heritage laws and regulations in different countries, unfortunately, cultural heritage is not always preserved because of looting and other types of vandalism.

# Key Terms

**Absolute Dating**: methods of obtaining calendar dates for archaeological sites or fossil finds, including dendrochronology, radiocarbon dating, and potassium-argon dating. Except for dendrochronology, these methods yield dates with standard deviations, resulting in a time range within which a site or fossil can be placed.

**Agency:** a theoretical perspective that discusses the role of the individual in shaping change in cultures and societies.

**Archaeology**: specialty in which researchers study humanity’s past; includes analyses of cultural materials such as flaked stone artifacts, animal bones, prehistoric art and personal ornamentations, etc., as well as settlement systems, taphonomy of archaeological sites, past social and political systems, and so forth.

**Archaeomagnetism**: an absolute dating method that uses variation in the position of the Earth’s magnetic pole over time. When a fixed clay feature such as a clay-lined hearth is heated to at least 650˚C/700˚C, the iron particles in that clay are aligned to the magnetic north pole at that time. The orientation of the iron particles then is compared to a magnetic north pole sequence to determine an age for the firing of the feature. This technique can be used for sites that are 10,000 years old or younger.

**Archaeometallurgy**: this archaeological specialty concerns the study of how metals were produced and used in the past.

**Bioarchaeology**: specialists who examine human bones to identify features of individuals and populations. These include health, age, sex, habitual activities, height, diet, and nutrition.

**Cartesian Coordinate System**: a three-dimensional grid system, in which horizontal axes (x and y) are combined with a vertical axis (z) to calculate the position of any given point. Each axis is perpendicular to the others. At archaeological sites, the x grid axis often corresponds to

North-South and the y grid axis represents East-West. The z grid axis is the elevation of each point.

**Cultural Resource Management (CRM)**: archaeologists who work in the field of CRM have projects that are based on recovering data about areas that will be impacted by new construction, such as the expansion of a road or the building of a parking lot, or otherwise potentially destroyed, for example, areas used by the military for training exercises. Many of these regions are federal- or state-owned and are subject to a number of laws, regulations, and reporting requirements.

**Darwinian Archaeology (evolutionary archaeology)**: a theoretical perspective that interprets changes in cultures over time as due to evolutionary processes, such as natural selection, known from biological evolution.

**Datum**: a reference point on the ground with known spatial coordinates, sometimes calculated as Easting (x) and Northing (y), as well as elevation (z). One or more datums are established at archaeological sites and used to set up site grids and for precision location measurement of artifacts, animal bones, structures, features, samples, and so forth, found during excavation at a site, as well as for archaeological survey.

**Dendrochronology**: an absolute dating method that provides calendar year dates based on the analysis of tree-ring sequences of thicker and thinner annual growth rings; used in parts of Europe and in the American Southwest, but only extends back in time some 8,700 to 12,000 years ago.

**Ecodynamics**: a theoretical approach that focuses on the interplay between the actions of humans and the environment using a complex web of interactions.

**Ecological Archaeology**: a theoretical perspective developed in the 1930s to interpret long-term cultural changes in the context of how people responded socially, economically, and technologically to local ecology and changes in local ecology.

**Ethnoarchaeology**: a discipline that uses the study of the behaviors of living people to better understand past patterns in the use of cultural materials, site organization, and settlement systems.

**Ethnography**: a subfield of cultural anthropology in which living people are studied using firsthand observation.

**Fauna**: bones of terrestrial and marine animals, birds, fish, and reptiles, as well as shellfish and microfauna.

**Gender Archaeology**: a theoretical perspective that examines the roles of women, men, and other genders, as well as their relationships, in prehistory.

**Geoarchaeology**: specialty in which geological analyses are used to aid in the interpretation of archaeological sites, such as the role of natural taphonomic processes, and of the formation of landscapes, in which sites are located, and landscape features.

**Geochemistry**: specialty in which researchers study the chemical composition of artifacts and bones, as well as participate in laboratory analyses to determine the absolute age of sites.

**Human Behavioral Ecology (HBE)**: a set of theoretical models, based in ecology, that uses human decisions about resources (including food) and resource use to examine diversity in cultures across geographic space and through time.

**Indigenous Archaeology**: this discipline relies on consultation and collaboration of archaeologists with native communities. It seeks to incorporate traditional knowledge, such as oral histories, values, and concerns of native groups about places in the landscape, to better understand the past. Native communities are active participants in interpretation.

**Landscape Archaeology**: a theoretical perspective that uses features of the natural landscape in combination with the placement of archaeological sites and the cultural materials at those sites to better understand potential cultural meanings, symbolism, and ritual in past societies.

**Macrobotanical Remains**: plant remains that are sometimes recovered from archaeological sites. They can include seeds and wood charcoal and are useful in reconstructing plant use (including plant foods) by earlier people, as well as aspects of local environments.

**Microfauna**: in archaeology, this term refers to very small animals such as mice, moles, and snails; these small animals are very sensitive to changes in local temperature and moisture and thus are valuable indicators of paleoenvironments.

**Multidisciplinary Approach**: to interpret the cultural materials and natural features of archaeological sites, site taphonomy, and landscapes, archaeologists collaborate with specialists within archaeology (for example, phytolith researchers, zooarchaeologists, archaeometallurgists, architects, materials conservators, and geoarchaeologists), as well as specialists from other disciplines (for instance, geochemists, geologists, ethnographers, and chronology laboratories).

**Networks and Boundaries**: A theoretical framework that focuses on the creation and maintenance of alliances (networks) and the definition of political and community groups (boundaries).

**Niche Construction Theory (NCT)**: the idea that humans actively change or manipulate features of the landscape around them and resources in those landscapes in ways that build a niche or habitat in which they can be successful over long periods of time. It incorporates evolutionary ideas from biology and applies them to humans. Archaeologists have recently used this theory to help explain the origins of food production and of domesticated plants and animals in human societies.

**Optically Stimulated Luminescence Dating**: an absolute dating technique in which quartz grains are extracted from sediment samples from sites and subjected to laboratory treatment that releases light trapped in these grains. The emitted light, which accumulated as electrons from ionizing radiation in the sediment, is measured and used in calculating the last time the quartz grains were exposed to sunlight. Past exposure to sunlight released all trapped light, so that it set the “clock” to zero, and the accumulated light represents the period of time since the quartz grains were buried.

**Paleoanthropology**: the study of human cultural and biological evolution by archaeologists and biological anthropologists; this term is commonly applied to biological anthropologists studying early hominin fossils.

**Paleoenvironment**: the types of environments and habitats characteristic of regions during the past; these developed due to changes in climate, as well as later human manipulation of vegetation and animal communities.

**Paleomagnetism**: this type of absolute dating technique uses reversals in the magnetic pole of the Earth; that is, at some points in time the South Pole was the magnetic pole, while at other times, such as today, the North Pole is the magnetic pole. The alignment of magnetic particles in rock such as lava can be measured to examine where the magnetic pole was at the time that layer was deposited. This technique is very useful for sites dating to 780,000 years ago and older.

**Palynology**: specialty that focuses on the study of plant pollen to better understand past environments, human impact on environments, hominin diet, and climate change.

**Phytoliths**: microscopic plant parts composed of silica or calcium oxalate that have shapes and sizes specific to particular plants; they usually preserve well and can lend insight into plant use, plant foods, and local environments at archaeological sites.

**Postprocessual Archaeology**: a theoretical perspective that emphasizes the study of particular cultures and their histories, especially the role of ideology and the actions of individuals; it does not stress the use of scientific method.

**Potassium-Argon Dating**: a radiometric dating technique that provides absolute dates based on the half-life decay rate of the radioactive isotope 40K (potassium) into the nonradioactive isotope 40Ar (argon); used in dating inorganic materials such as lava flows or tuff beds in the period from 100,000 years ago to hundreds of millions of years ago, and thus provides bracket dates for archaeological sites and hominin fossil finds.

**Processual Archaeology**: a theoretical perspective that uses social, economic, and environmental dynamics to interpret cultural changes over time; it is based on the use of scientific methodology.

**Radiocarbon Dating**: an absolute dating method that uses the decay rate of the radioactive isotope carbon-14 (14C) to calculate the age of organic materials, such as wood charcoal, found at archaeological sites. It can be used to date materials from the past 40,000 years, and possibly up to 60,000 years ago. Due to fluctuations in the amount of 14C in the Earth’s atmosphere over time, radiocarbon dates must be calibrated (adjusted) to reflect the actual date of a sample.

**Radiometric Techniques**: dating techniques that use the principle of a known rate of decay of specific radioactive isotopes into stable isotopes over time; examples include radiocarbon dating and potassium-argon dating.

**Relative Dating**: dating techniques that provide a sequence of “older” and “younger” rather than calendar dates; examples include stratigraphy and seriation.

**Remote Sensing**: uses technology such as satellite images, ground-penetrating radar, and LiDAR (light detection and ranging) to aid in the location of archaeological sites and buried or vegetation-covered features of sites.

**Scientific Method**: the process of gathering information (through observation or experimentation) and using this information to create and test hypotheses (ideas); testing hypotheses allows new information to be added and facilitates corrections that need to be made to the hypotheses.

**Seriation**: a relative dating method in which the frequency of artifact types or styles is used to construct a chronology of “older than” or “younger than” based on the popularity of types or styles over time.

**Site Taphonomy**: the natural and cultural processes that affect archaeological sites. Natural processes include the actions of animals such as hyenas who might consume animal bones left at a site, the effects of rain and sun on exposed archaeological materials, and erosion. Cultural processes include pit digging by later occupants at a site, reuse of stone artifacts left at a site, and modern-day looting.

**Spit**: a term used by some archaeologists to describe an excavation unit that has an arbitrarily assigned specific depth and size; it is especially useful if natural or cultural layers are not easily seen in the stratigraphy.

**Stratigraphy**: the layers or levels at an archaeological site. These can be defined as natural (geological) or cultural; can be used as a relative dating technique in which cultural materials found in deeper levels or layers are older than those in overlying levels or layers.

**Thermoluminescence Dating**: an absolute dating technique that uses the principle of when an artifact such as a stone tool or a piece of pottery was last exposed to heating (as in a fire). Heating releases trapped electrons (light) and sets the clock to zero. After the heating event, ionizing radiation in the sediment of a site bombards the stone artifact or ceramic and electrons begin to accumulate in those pieces. In the laboratory, the electrons can be released as light and measured, and then used to calculate when in time that piece was heated.

**Total Station**: equipment that combines a theodolite (which measures vertical and horizontal angles) with an electronic distance meter (EDM), which uses a laser beam to measure the distance from the total station to an object or point (where a prism is placed). The angles and distance are used to calculate x, y, and z coordinates (Cartesian coordinates) for each point.

**UTM Coordinates**: Universal Transverse Mercator coordinates are Easting and Northing numbers that are based on a system of metric grid cells that divide the world. Each Easting and Northing set of coordinates thus provides an extremely specific geographical location.

**Zooarchaeology**: the study of animal bones found at archaeological sites. Zooarchaeologists usually identify the genus and species (when possible) and provide information on the types of animals present, as well as examine animal bones for stone artifact cut and percussion marks, evidence of use as tools, presence of shaped bone tools, and burning.