ACRA Methods & Technologies White Papers

Geoarchaeology

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Overview

Geoarchaeology addresses the interface between the earth sciences and archaeology. Cultural finds are always tied to a landscape-either on an exposed surface or buried underneath it. Irrespective of the aims of an archaeological project, the association between artifacts and the ground is critical to assessing significance from the compliance perspective, Systematic associations between artifact types, periods, and frequencies with landscapes enables CRM practitioners to structure observations in a way that is meaningful for clients and regulators. An understanding of landscape history provides an independent context for artifacts that facilitates informed decisions on site significance.

Assembling landscape histories and assessing site integrity are the most critical objectives for the geoarchaeologist. Landform histories are grounded in absolute dating techniques which, in North America, still center on the radiocarbon technique and are increasingly dependent on AMS and bulk sediment dating of deposits. Archeomagnetisni and thermoluminescense are increasingly used while dendrochronology and obsidian hydration are routine across the western U.S. To develop assessments of site integrity geoachaeologists draw on techniques from geology, sedimentology, hydrology, geomorphology, stratigraphy, chemistry, geophysics, photogrammetry and engineering as well as archaeology. Prehistoric and historic archaeology routinely utilize geoarchaeological services.

Prehistoric archaeology involves an understanding of subsurface deposits that can be divided into three basic categories: *geological deposits, soils,* and *anthropogenic sediments. Deposits* are laid down geologically (by gravity, water, or wind) and represent the dynamism of the natural environment. Artifacts in such settings are often in secondary context. *Soils* are weathered (chemically or physically degraded) sediments that represent stable periods of a landscape's history when prehistoric evidence is likely to be preserved in place (thus retaining integrity and factoring into significancedeterminations). Finally, *anthropogenic sediments* are of cultural origin and are evidence of human activity in place; features such as roasting pits, storage facilities, house floors, and planting fields are examples. Typically anthropogenic deposits and soils are found together and represent the most sensitive archaeological contexts. All three contexts are expressed in the range of natural environments: from deserts to temperate woodlands and from coastal plains to uplands and alluvialvalleys.

Geoarchaeological applications to historic sites are relatively recent. Strategies originally stressed remote sensing (magnetometers and GPR) to detect large scale features at battlefields (Civil War earthworks, for example), historic house foundations and abandoned town centers. Current efforts are directed to complex urban areas. Here deep testing in conjunction with archival records documents historic land use practices on scales ranging from individuals to defunct industries (tanning, for example) to colonial municipalplans.

Applications

Invasive techniques are almost always necessary for subsurface testing. Practitioners use a variety of coring devices (from a portable 1-4" diameter corer to a truck mounted, hydraulically activated Giddings rig) and tractor mounted backhoes for large exposures. The objective is to obtain as much stratigraphic exposure as possible across the site or project landform. Ideally, the backhoe is placed at critical breaks in the landform or where archaeological sensitivity is high; if there is concern that critical site contexts will be compromised backhoe location can be locally repositioned. Corers are used to bridge subsurface sequences between the broader backhoe sections. This method is preferable for obtaining representative cuts, securing overall coverage and maintaining cost efficiency. In general, stratigraphic, sediment, and radiocarbon samples are secured from backhoe sections, but wider diameter cores can also provide sufficient sediment. Soil and sediment analysis is dictated by stratigraphy and purpose. Geochemistry is valuable for assessing soil development and perishable cultural debris. Grain size and mineralogy are more critical for evaluating natural stratigraphy. Sediments are analyzed in-house or by outside labs. Radiocarbon dates are always performed at special labs.

Geoarchaeology can and should be integrated in each phase of the compliance process. In this presentation, I assume that a variant of the Phase I, II, and III cycle applies for most investigative settings. For *Phase I* surveys, a geoarchaeological assessment would involve examination of the County Soil Survey and brief examination of the shovel test logs to determine the approximate age of the soil and to identify the nature and pattern of any disturbance to the substrate. Such an assessment links landforms to archaeological distributions, thus avoiding costly and labor-intensive pedestrian survey. For example, recognition of surface glacial gravels will eliminate the need for further testing, since the age of the landform precludes the presence of stratified cultural deposits. In Phase II testing, "buried A" horizons and upper "Cambic B" commonly preserve stratified Late Archaic to Woodland occupations in the Eastern United States; this association provides a model for delimiting site margins in archaeologically rich floodplain. In the western United States an analog is the presence of thinly stacked "A-C" horizons and/or slightly deeper "A-Bk" successions in arroyo fills or cienagas Phase III site mitigation efforts typically address site formation issues and more detailed site histories. Such efforts will require detailed field work and column sampling for geochemical, grain size and mineralogical analysis.

Cost Efficiency

It is my experience that smaller CRM firms rarely utilize geoarchaeologists, claiming that costs are prohibitive. As indicated, however, geoarchaeology is cost-efficient as a prospection (Phases I and II) as well as a data recording technique (Phases II and III). It is ***optimaIly*** incorporated on the front end of project design, irrespective of Phase. In nearly three decades of work, I have found that fiscal outlays for the geoarchaeological component in Phases I and II should be l0-20% of the total project. In many cases a geoarchaeological assessment is all that is needed to test for archaeological compliance. When the method is utilized the net costs for Phases I and II are reduced by 25-35%, much of the reduction coming in the form of labor cost savings because of the higher efficiency and dependability of geoarchaeological work. Many SHPO's and federal regulators look upon the strategy favorably, accepting it as a viable alternative to standard pedestrian survey and testing. Phase III research designs almost invariably integrate a geoacheological component to streamline depth and extent of excavation areas. Geoarchaeologically based landform histories can assess archaeological preservation and result of huge cost savings.

Specialist Standards & Training

There is no codified structure for geoarchaeological certification. A few universities support geoarchaeologists in a variety of departments, typically in geology. geography or anthropology and more rarely in pedology or geophysics. Geoarchaeologists must be familiar with most of the sub-fields of the earth sciences. An advanced degree and extensive experience are necessary. In the case of larger projects, the PhD, a broad range of experience, or some form of accreditation are desirable, since geoarchaeologists may be called on to provide expert opinions and testimony in complex compliance determinations. It cannot be stressed more strongly that the geoarchaeologist must have extensive and formal archaeological training since the practitioner is invariably brought on site to answer archaeological questions. Until recently there has been a tendency to utilize specialists from the earth sciences who were unversed in archaeology (for example structural geologists who understood valley bedrock histories but were unfamiliar with Holocene sequences) and provided no relevant information. In this regard, a recent determination in Utah that requires formal state licensing to practice any form of geology underscores the difficulties the CRM industry faces in choosing an appropriate consultant. Most CRM firms do not have in house geoarchaeologists and typically hire outside specialists. It is necessary that the specialist be familiar with CRM problems and objectives. Experience is the key to success in geoarchaeological practice because of the lack of structured training programs.

Interested parties are directed to the ACRA web site to obtain a list of firms specializing in geoarchaeology and related services.

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