11. SOIL CHEMICALS AND SITE LAYOUT

Human activities leave chemical footprints that can be used to interpret the layout of the site and occupations followed by people who lived there.

When most of the features had been dug, and before the Gradall came to dig away the well area, a chemical survey was conducted over the entire site core, to provide a fine-grained map of site chemical residues.

A thirty-inch survey interval was chosen because it fit conveniently into the five-foot grid. A one-meter interval has been pronounced "ideal" for intra-site sampling, although intervals as small as ten centimeters have been used in some applications. The detailed sample was taken after excavation, from the bare excavated soil. A corresponding plowzone survey was not taken because recent research has shown that similar results will be returned from either topsoil or subsoil samples, and the expense of taking both sets of samples is not justified (Walker 1992: 70).

In Delaware, ten-foot intervals have commonly been used to map intra-site chemical distributions; this interval was used in the pre-excavation survey at Bloomsbury (Grettler *et al* 1994: 152).

Potassium, from wood ash or other domestic refuse, is commonly concentrated on eighteenth century house sites. At the St. John's site in St. Mary's City, the potassium was concentrated at a building identified as the kitchen (Keeler 1978:67). A strong overlay of potash in the soil has been construed to indicate a home industry of pearl ash production (Grettler *et al* 1995: 75). At Bloomsbury, potassium was distributed in pockets across the site, encompassing the pits on the northwest and the probable house location north of the well.

Results from King's Reach were similar. The potassium was concentrated in an arc east of the house, in what was interpreted as an activity or ash-disposal area, but not in the immediate house area (Pogue 1988:10).

Phosphates have long been understood as the most obvious indicator of human activity on a site. Phosphorous compounds in the soil can come from foodstuffs, garbage, and human waste (Sopko 1983: 25; Pogue 1988:4). Phosphate concentrations have been used to identify animal pens on other Delaware sites (Grettler *et al* 1995: 137). At King's Reach, in Maryland, a high phosphorous level was found inside the house, as well as surrounding the doorways. Concentrations inside the house were interpreted as resulting from "general organic waste" rather than human excreta (Pogue 1988:9).

High phosphorous readings in the ten-foot sample northwest of the site core may represent animal pens. These areas are poorly drained, and exhibited no evidence for fencing. A phosphate concentration associated with features in the northwest part of the site core may indicate an activity area.

Calcium in the soil may indicate the presence of bone or shell from food preparation or waste (Sopko 1983:25).
Calcium has been identified in Southern Maryland as a tag for trash deposits. At King's Reach, calcium generally reflected trash (Pogue 1988: 4, 9). Together, phosphorous and calcium overlapping may point to a food preparation area.

Calcium was concentrated at Bloomsbury east of the eastern well, just beyond the eastern row of features. In the same general areas high pH readings indicated bone or shell disposal.

At Bloomsbury, high potash and high calcium overlapped around the two cased wells, but did not include the vicinity of the supposed pump. Therefore, one may conclude that the "pump" never was part of domestic food preparation and consumption activities.

Metals also are likely to accumulate wherever people live and work. Copper and lead have been shown to be ubiquitous in garden soils of Britain, both city and country. Sources of these metals might include the glazes of discarded pottery and metal wastes. Research in Greece indicates that such trace metals accumulate in measurable amounts even on sites that were occupied a "mere" 200 years (Bintliff, Davies, Gaffney, Snodgrass, and Waters 1992).

Zinc, copper, and iron are part of the standard agricultural soil sample provided by most laboratories, including the University of Delaware. Iron might be the most useful trace elements, since iron nails and other hardware are the commonest metal objects on a domestic site in America. Even after nails have been totally rusted away or removed, a "halo" of iron compounds will remain in the soil.

Sometimes iron-rich fuels, such as turf, might leave iron residues when they burn (Dockrill and Gaiter 1992: 27). Since peat was not commonly used as a fuel in Delaware, any peak of iron must come from a source other than mere combustion, such as metal working or hardware residues. Lead from paints and pottery glazes can also be used to locate structures.

Iron residues in the thirty- inch survey showed substantial peaks near features 22, 11 and 23 when the raw data was plotted. A smoothed map indicates that elevated iron outlines the site core, with a possible concentration north of the wells. These iron peaks may indicate the locations of iron residues of corroded nails from the decayed house. If this is the case, at least one incarnation of the house may have occupied a space roughly bounded on the south by the east well and on the north by the burned patch.

Calcium, from the calcium carbonate in mortar, has been used to identify brick structures, such as hearths. Magnesium mirrors calcium in many cases where mortar is involved (Grettler et al 1995: 75). A high (less acid) pH may reflect the shell and bone residue of food preparation (Catts, Custer, Jamison, Scholl, and Iplenski 1995: 98).

Interpretation of chemical residues generally consists of a map or maps showing peaks of certain elements. Mapping presents some difficulties.

Contour maps are the commonest method of interpretation, but they tend to be busy and confusing. Some smoothing allows the reader to interpret the information more clearly. On the following pages, the detailed topographies are displayed together with a smoothed version generated by the computer. This technique worked well in the initial phosphate

INTERPRETATIONS DERIVED FROM SOIL CHEMICAL TESTS ELSEWHERE

Site Name	Citation	Description of context	Chemical Elements	Interpretation
New Windsor NY	Sopko 1983	enlisted hut kitchen feature 29	phosphorous and calcium	food preparation and consumption
New Windsor NY	Sopko 1983	officers' kitchen feature 24	phosphorous and calcium	food preparation and consumption
Strickland, DE	Catts, *et al* 1995	yeoman's house	phosphorous and calcium	animal pen
Strickland, DE	Catts, *et al* 1995	yeoman's house	magnesium	disposal over fence
Strickland, DE	Catts, *et al* 1995	yeoman's house	less acid (high pH)	bone, shell, and other domestic waste
Whitehart, DE	Grettler *et al* 1995	yeoman's house	calcium	mortar of a chimney
Powell, DE	Grettler *et al* 1995	yeoman's house	phosphorous	animal pen
St. Johns, MD	Keeler 1978	town lot	potassium	kitchen
King's Reach, MD	Pogue 1988	yeoman's house	phosphorous	house interior
King's Reach, MD	Pogue 1988	yeoman's house	potassium	ash disposal
King's Reach, MD	Pogue 1988	yeoman's house	calcium	food preparation trash

survey during Phase II outlined in Chapter 8. At the William Strickland site nearby, Catts, Custer, and their colleagues used a different approach. They isolated the various concentrtions on a site map and interpreted them in terms of excavated features (Catts, Custer, Jamison, Scholl, and Iplenski 1995:99).

Plate 30

Evidence for a processing area east of the house

Feature 32, one of the basin-like features, was five feet across, with two postholes in the bottom. It contained fired daub and bone. Iron and calcium deposits peaked in the soil chemical sample near this feature.

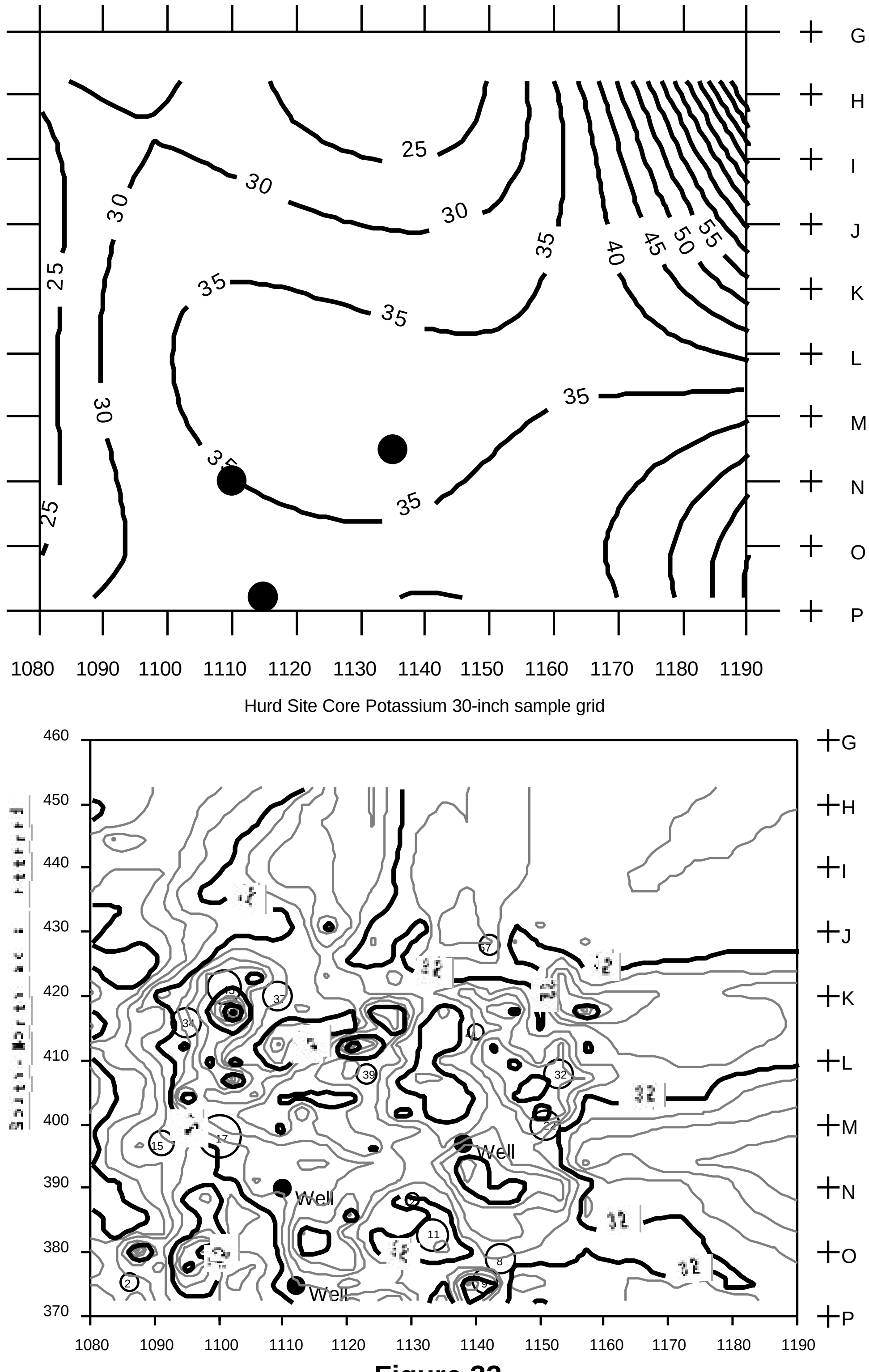

Figure 32

Map of 30-inch survey potassium, computer-smoothed rendering above and the raw data mapped below. The apparent dropoff in the edge of the refined map is an artifact of the statistical method.

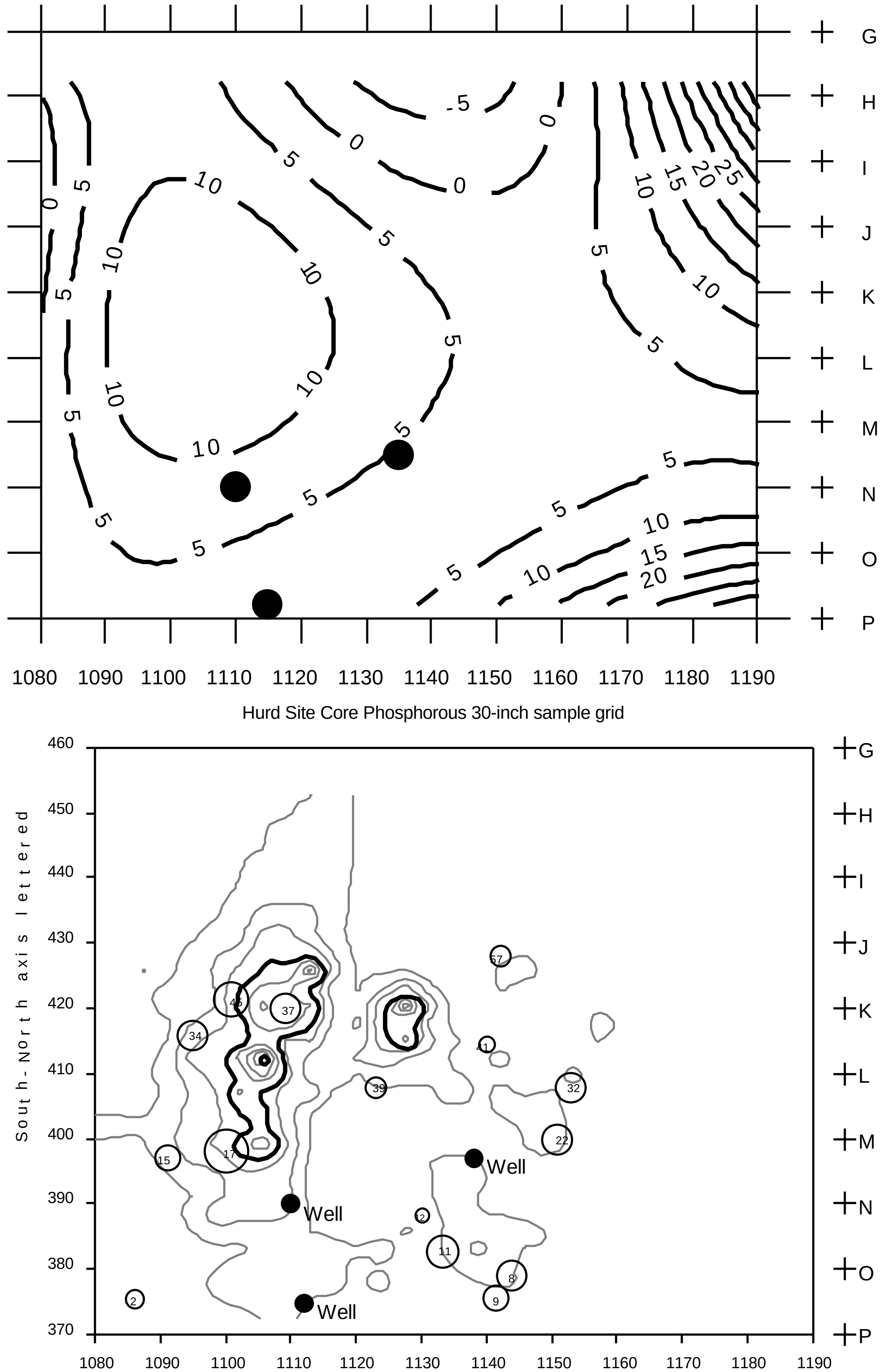

Figure 33
Map of 30-inch survey phosphorous, computer-smoothed rendering above.

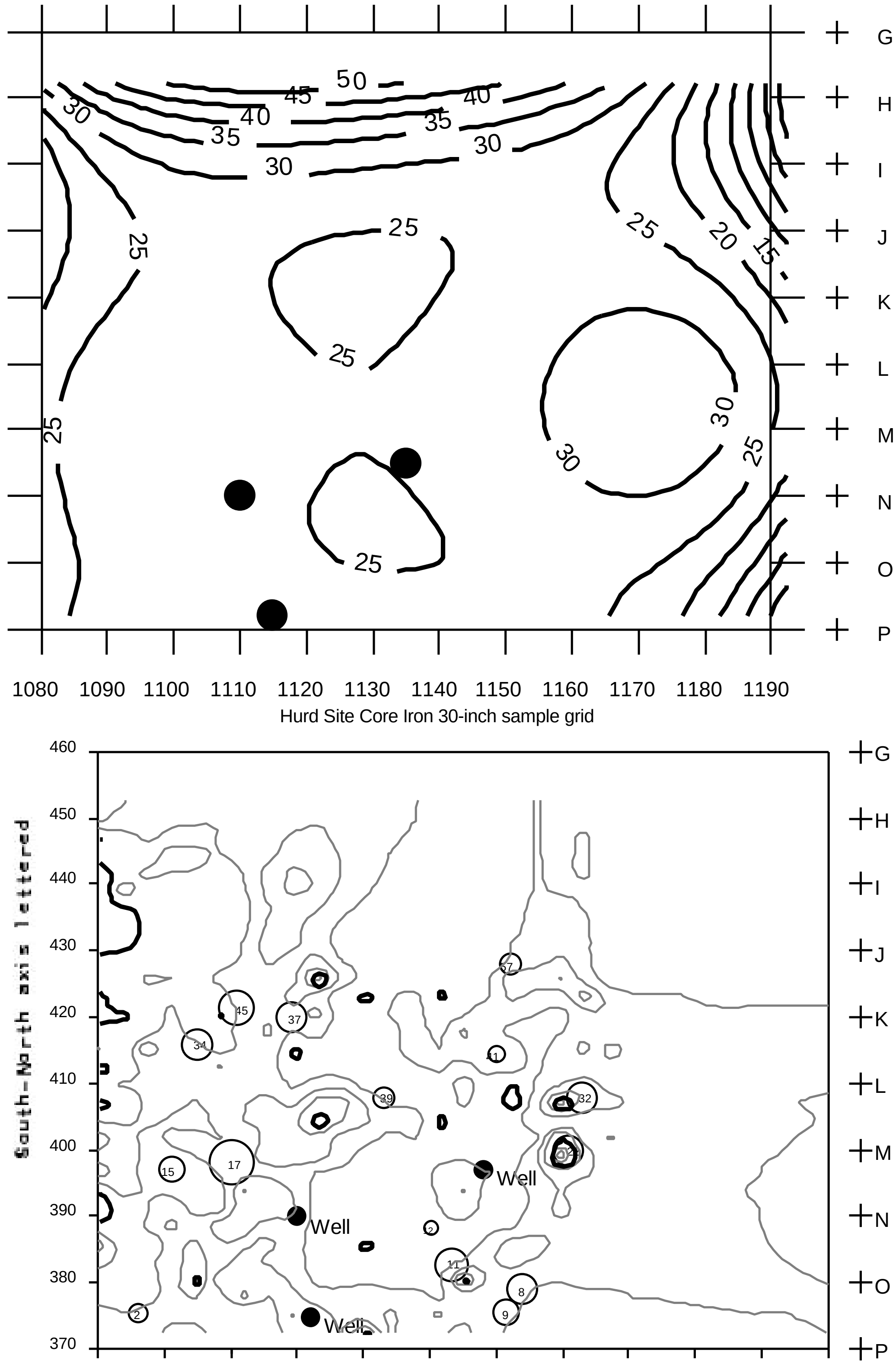

Figure 34
Map of 30-inch survey iron, computer-smoothed rendering above.

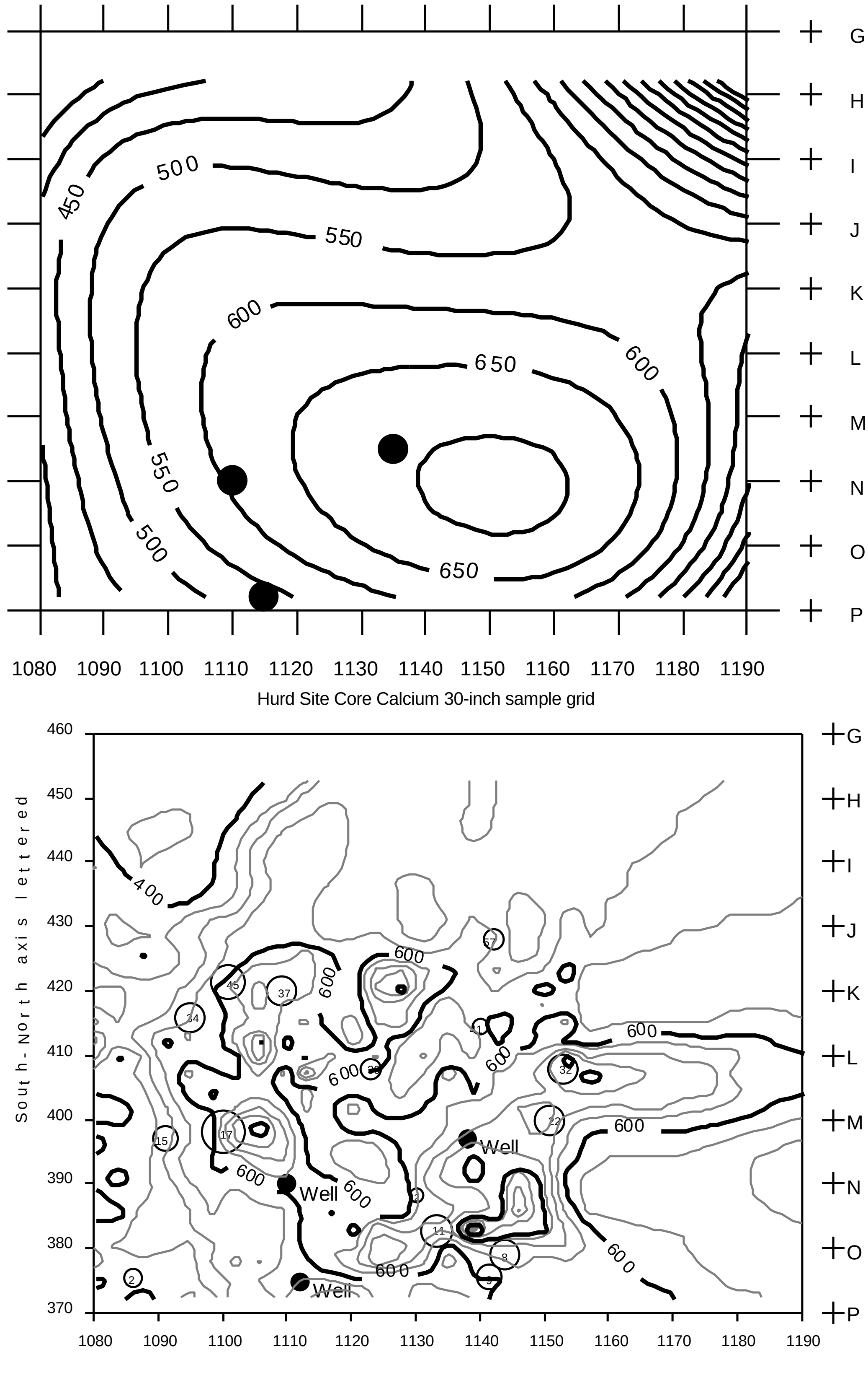

Figure 35

Map of 30-inch survey calcium, computer-smoothed rendering above.

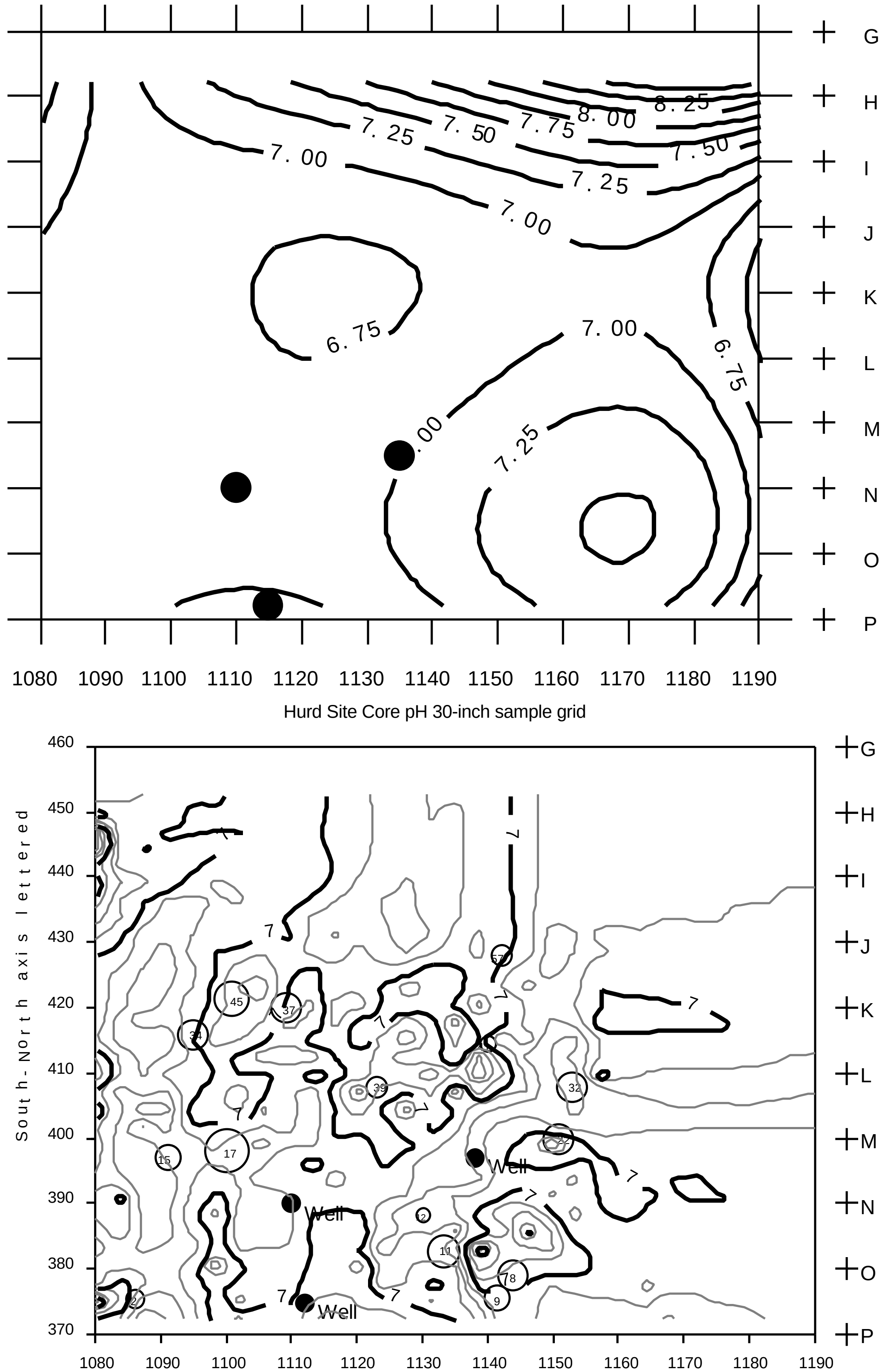

Figure 36
Map of 30-inch survey pH, computer-smoothed rendering above.

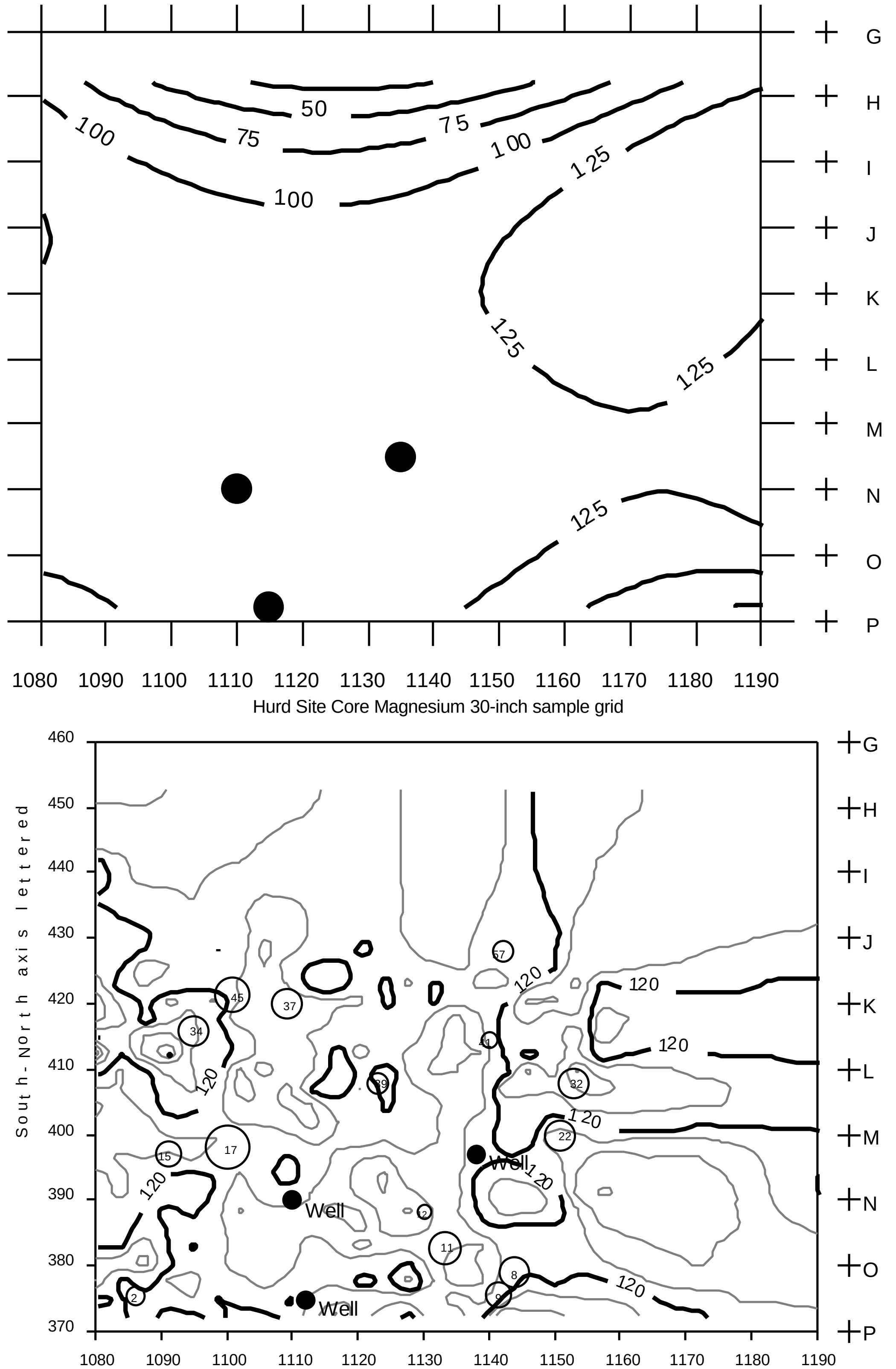

Figure 37

Map of 30-inch survey magnesium, computer-smoothed rendering above.