data are for minus 250-mesh material while this study used the minus 80-mesh fraction. Nevertheless, because no other data are available, this comparison is presented as a guide to regional and local metal concentrations of the area.

Sediments from Camp, Banana, Upper Sunken, Anne and Turtle Lakes obviously contain strongly anomalous levels of Cu and Zn, while Lower Sunken Lake contains slightly anomalous concentrations of Cu and moderately high Zn levels (Figs. 102 to 106; Tables 24 and 25). Pb values, however, show a distinct, abrupt and limited distribution as shown by Cu/Pb and Zn/Pb ratios and mean concentrations (Tables 25 to 27).

Variation of Cu, Pb, Zn, Fe and Mn concentrations across the lake bottom is considerable, especially for Fe and Mn (Table 26). Although amorphous Fe and Mn oxides play important roles in scavenging Cu, Zn and, to a lesser extent, Pb from lake and stream waters (Horsnail et al., 1969; Garrett and Hornbrook, 1976; Coker and Nichol, 1975; Chao and Theobald, 1976) they do not appear to be important factors in localization of Cu, Pb or Zn in lake sediments sampled in this study. This is particularly well documented by lake sediment core data (Figs. 108 to 126). Allan et al. (1973) also reported poor correlations for Fe and Mn with Cu, Pb and Zn in near-shore lake sediments from the Bathurst region.

With the exception of the eastern shore, Camp Lake contains significantly higher Pb concentrations than Banana

Lake. Passing from Camp into Upper Sunken and then Lower Sunken Lakes, there is a marked decrease in Pb values with the lowest values occurring in Lower Sunken Lake.

Within Camp Lake, the highest metal values are generally found towards the north to northwest end of the lake, i.e. closest the ore zone. In samples nearest the eastern shore, where sample depths are the shallowest, Pb levels are approximately 10 to 30 times lower than elsewhere while Cu and Zn values remain high.

A similar situation exists at Anne and Turtle Lakes (Figs. 105 and 106; Tables 25 and 26). Although significant Zn-Pb-Cu mineralization can be found along the "mineral horizon" south of Anne Lake (Figs. 17, B6, B20 and B26), Turtle Lake is well removed from mineralization and metal-rich till; however, Turtle Lake receives drainage from Anne Lake whose waters are highly anomalous in Cu and Zn (Figs. 12 and 101). Cu, Pb and Zn values are highly anomalous in Anne Lake sediments; whereas, down drainage in Turtle Lake Zn, Cu and Pb values are lower by factors of 2, 3.3 and 5.5 respectively and, except for very low levels of Pb, the values can still be considered highly anomalous (compare Tables 24 and 25).

Within Anne Lake the higher Pb values, as at Camp Lake, are generally restricted to those samples taken from depths exceeding 20 feet; however, the deepest sample (376) contains the lowest Cu, Pb and Zn values but highest percent L.O.I. In addition, the higher Pb values also relate to the point where the "mineral horizon" enters Anne Lake (compare Figs. 17 and 105).

At Turtle Lake, the highest Cu and Zn values are found in samples taken from shallow to intermediate depths (≈10 to 30 feet). Samples collected from the deeper portions of Turtle Lake contain somewhat lower values. Conversely, collection of samples from too near shore ($\leq$ 8 feet water) may also result in overall lower metal values (Table 25). Therefore, collection of sediment samples from intermediate depths (≈15 to 35 feet) or near the break-in-slope of the lake basin appears optimal (cf. Hoffman, 1976, p. 338; Winter, 1976). Possible explanations for variation of metal content with water depth are considered in Chapter 5.

Although lake sediments from this study contain strongly anomalous values they also contain low values and, unlike lake waters, comparison of metal values within lake sediments shows that Cu, Zn and Pb levels can fluctuate over an order of magnitude within a given lake. Nevertheless, almost any sample site chosen within these two lakes would be anomalous on a regional scale.

Ag and Cd values are low in all lakes and therefore, are not presented in figures. Camp and Anne Lakes contain the highest values (range <1 to 15 ppm Ag and 5 to 50 ppm Cd) while adjacent lakes (e.g. Banana and Turtle) contain much lower Ag ($\leq$1 ppm) and Cd (2 to 15 ppm) values. High Cd and Ag values tend to correlate with high Zn and Pb values respectively.

C. Lake Sediment Cores

Short (4 to 12 inch) cores were collected from Camp and Banana Lakes as part of a follow-up study on metal distribution within lake sediments (Figs. 107 to 127). In general, sediment cores consist of a basal (?) layer of sand-silt-clay or dense compact silt-clay, of unknown thickness, which occasionally contains pebbles. Deposited on this is a one to two inch thick, soft silt-clay which sometimes contains a friable, whitish, silty material (marl?). In several cores, plant fibers were noted in a thin (1 to 2 inch) zone near the contact of these layers. Above the marl an organic, watery sediment (≥ 70 percent H_2O by weight) begins to gradually appear over a one to two inch zone; however, in some cases, the contact is knife sharp.

In general, the upper one to three inches of a core are usually bright orange and black due to oxidation of Fe and Mn, while lower portions of the core range from tan to a medium or dark grey depending on organic content and Eh. Fe and Mn nodules increase in size, numbers and definition towards the sediment-water interface where they often form a nodule layer one to three centimeters thick. Although Fe and Mn nodules are abundant at the surface and the sediment is brightly colored, organic content remains unchanged relative to the underlying medium grey watery sediment (algal gyttja). Interspersed within the gyttja are thin

(1 to 3 mm), closely spaced sharp to diffuse black bands (Fig. 118 and Plate 13) and diffuse irregular Fe and Mn nodules. Figure 127 is an idealized representation of the sedimentary stratigraphy which is remarkably similar to sediment cores described by Karrow and Anderson (1975) from Louise Lake, Ontario, except that the sedimentation rate is approximately 20 times less at Camp Lake.

Cu, Fe, Mn, Pb and Zn concentrations vary almost as much with depth as they do over the sediment surface. Variations exceeding an order of magnitude are not unusual, especially for Mn (Figs. 109, 119 and 120). Rapid changes in metal values (up to 20x) over the length of a core are largely the result of changes in sediment texture (e.g. Figs. 110 and 118). Within individual sediment types (e.g. gyttja, silt-clay etc.) variation is significantly lower (Figs. 109 and 113). Relative to Cu and Zn, Pb displays the widest range of values with respect to depth, particularly in cores that penetrate the dense sand-silt-clay layer where metal values are invariably much lower (Figs. 118 and 120). Nevertheless, Cu and Zn values, although lower in the sand-silt-clay (except Cu in core 1645, Fig. 123), are still relatively high (500 to 1200 ppm).

Cu, Pb, Zn and L.O.I. values usually remain somewhat constant with respect to depth or increase to a maximum and then decline towards the bottom of the core. Conversely, Fe and, in particular, Mn increase - often dramatically - towards the sediment-water interface (Figs. 109, 113, 119 and 123). Consequently, a negative correlation between Fe/Mn levels and base metals is well developed (Figs. 112, 115 and 124); however, in a few instances there is a gross sympathetic relationship (Figs. 110 and 117).

In general, Cu and Zn trends closely parallel one another while Pb trends, although similar to Cu and Zn, often display somewhat divergent trends (Figs. 115 and 120). Percent organic matter (L.O.I.) trends are somewhat like those of Pb, in that, while similar to Cu and Zn trends, L.O.I. trends commonly fluctuate independently of Cu and Zn, particularly in Banana Lake where negative correlations are common (Figs. 123 to 125).

Sediment cores 1424 and 1427 (Figs. 115 and 118) are strongly enriched in Cu and Zn and analysis of a one to three millimeter black band at the oxidation/reduction interface in core 1427 (Plate 14) indicates a minimum of 2.2 percent Cu and 1.3 percent Zn. These Cu and Zn peaks contain correspondingly low to moderate levels of Fe, Mn, Ag and Pb.

In some sediment cores (e.g. core 1423, Fig. 114) a double layer (repetition) or sudden shift in Fe content can be seen. A similar pattern is displayed by Zn, although it is the inverse of Fe.

D. Stream Sediments

Stream sediments were not collected in sufficient quantity or over a large enough area for detailed interpretation. Nevertheless, data are offered (Table 28) as a guide to metal values in stream sediments adjacent to and draining the Main Zone. In B-C stream, particularly the lower and middle portions (161, 159), highly anomalous Cu values occur, while Pb and Zn levels, although anomalous, are lower presumably because of the high immobility of Pb and the high mobility of Zn. At site 105, approximately 4000 feet down drainage from mineralized zones a highly anomalous value of 233 ppm Zn is recorded; whereas, Cu and Pb values are low to moderate.

Table 28. Metal content[1] of stream sediments adjacent to mineralized zones at Camp Lake.

Site Number	Location	Cu	Pb	Zn	Fe%	Mn
163	Banana L. exit	120	7	162	1.3	96
161	Mid B-C stream	1113	37	45	4.5	376
159	Camp L. entrance	850	103	373	3.4	1282
165[2]	Camp L. exit	71	12	120	1.0	121
173	800 ft. south U.S.L.	119	19	130	1.5	142
105	4000 ft. south U.S.L.	120	35	233	1.5	120
167	Hi Lake exit	131	35	71	2.4	686

1: Total attack, minus 80-mesh. All values in ppm except where noted.

2: Exceptionally coarse sediment which contained little silt or clay relative to the other samples.

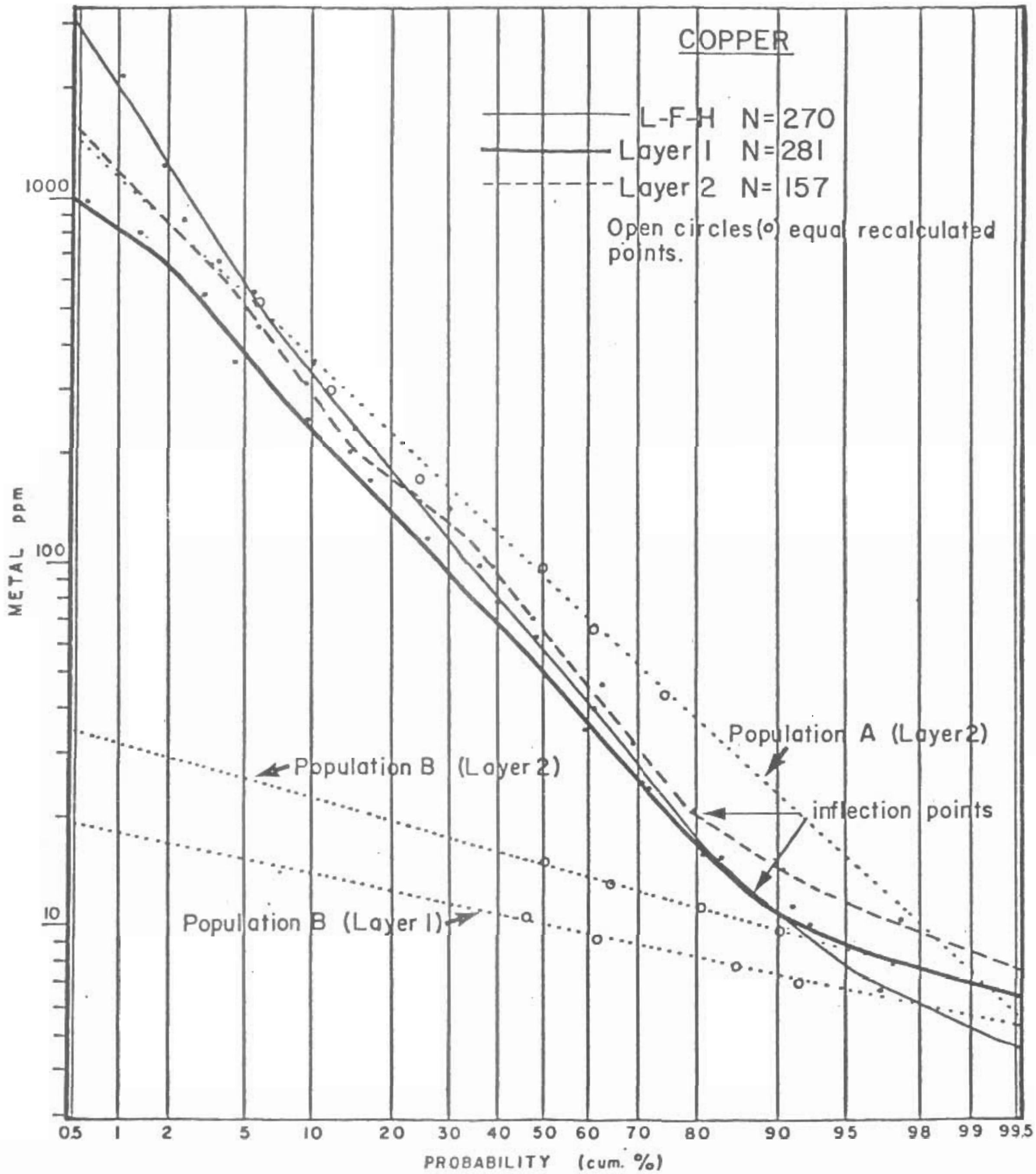

Figure 21. Log probability plot of Cu, -80 mesh fraction, total attack. Black dots represent original data. Open circles are construction points used in obtaining partitioned populations shown as straight dotted lines.

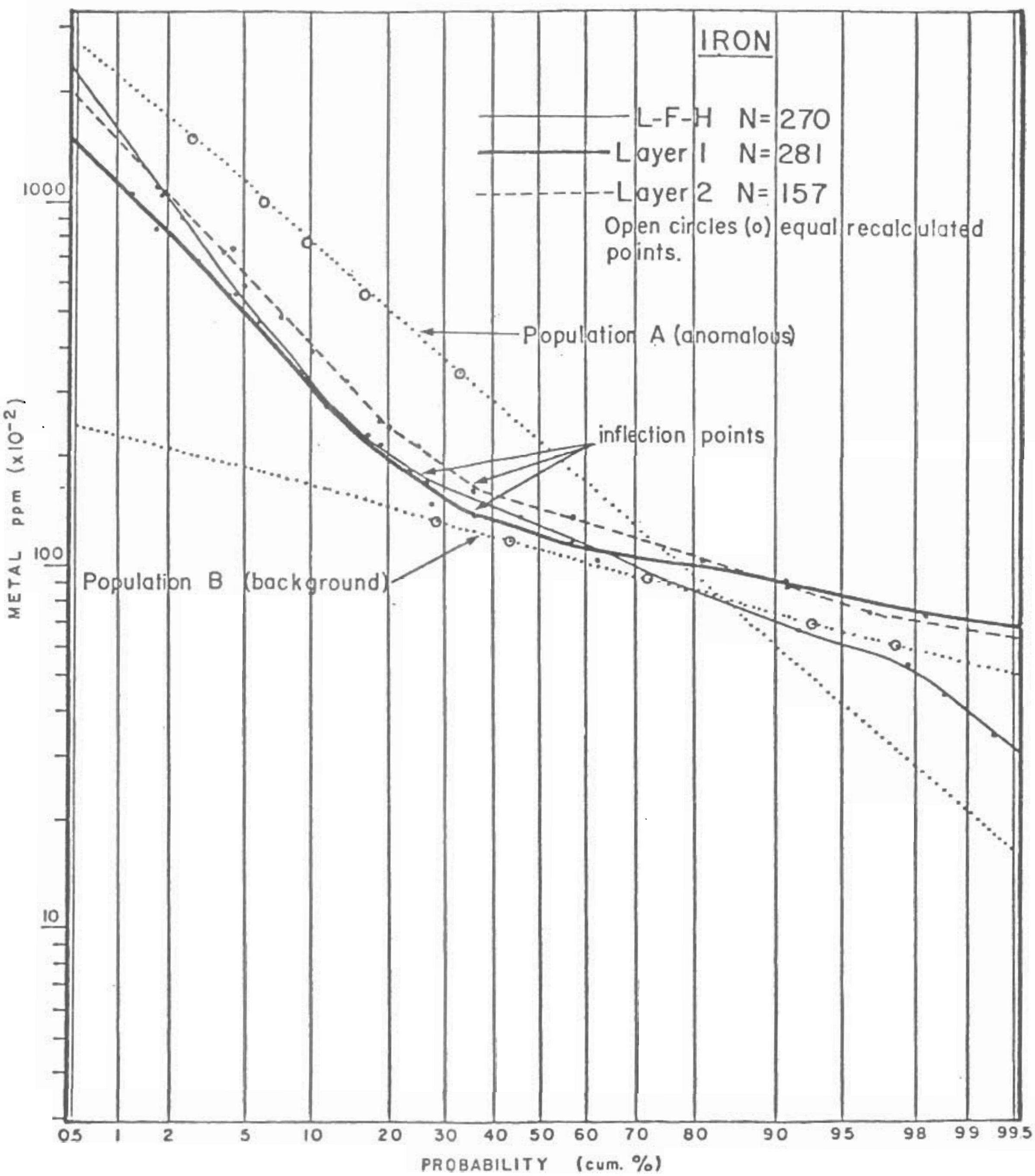

Figure 22. Log probability plot of Fe, -80 mesh fraction, total attack. Partitioned populations are from the L-F-H horizon. Pop. B approximates background for all three soil layers. Pop. A is one possible interpretation of the L-F-H horizon. Alternatively, an anomalous population (>pop. B) and a depleted population (<pop. B) may be present. See Fig. 21 for explanation of symbols.

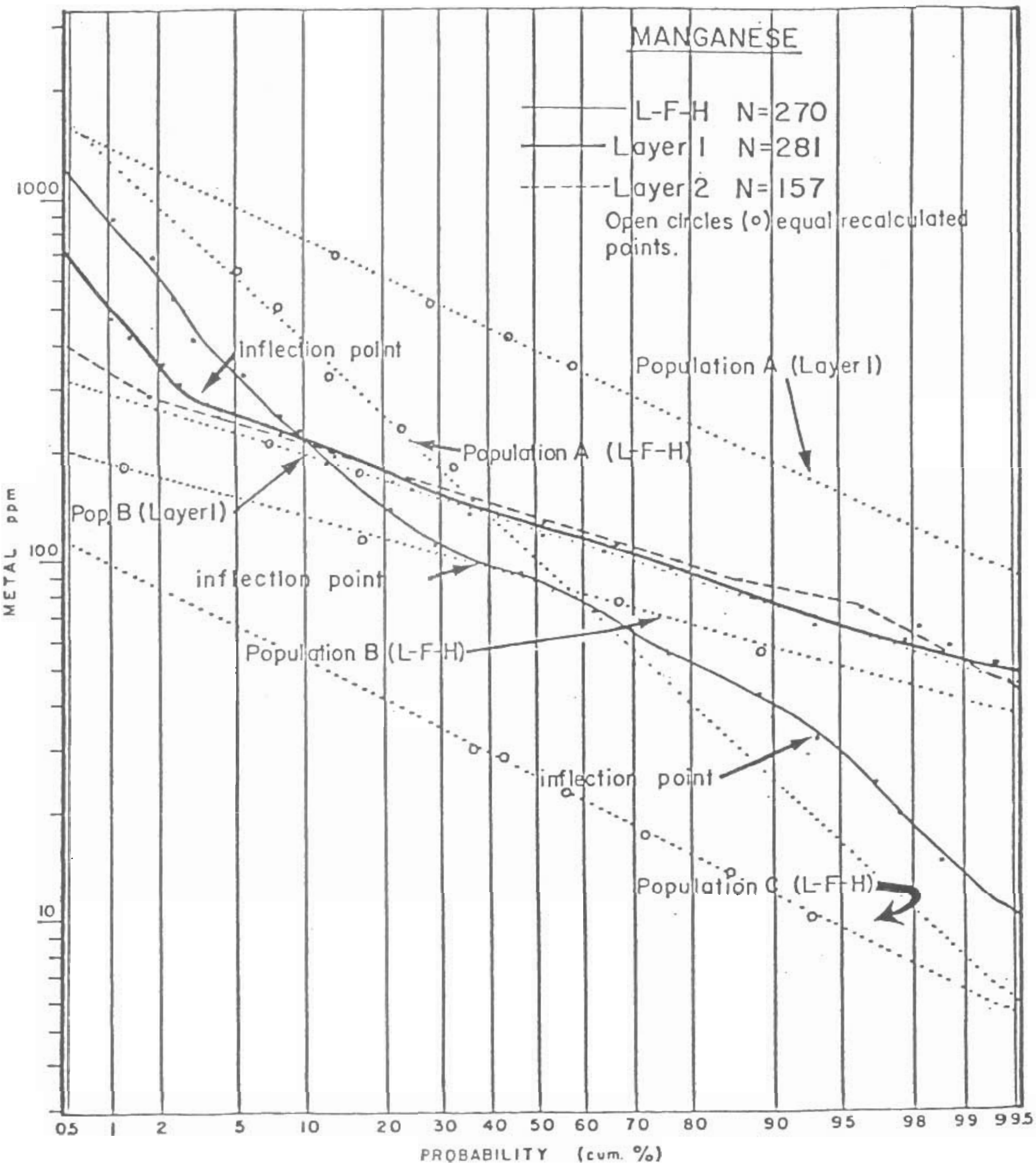

Figure 23. Log probability plot of Mn, -80 mesh fraction, total attack. See Fig. 21 for explanation of symbols.

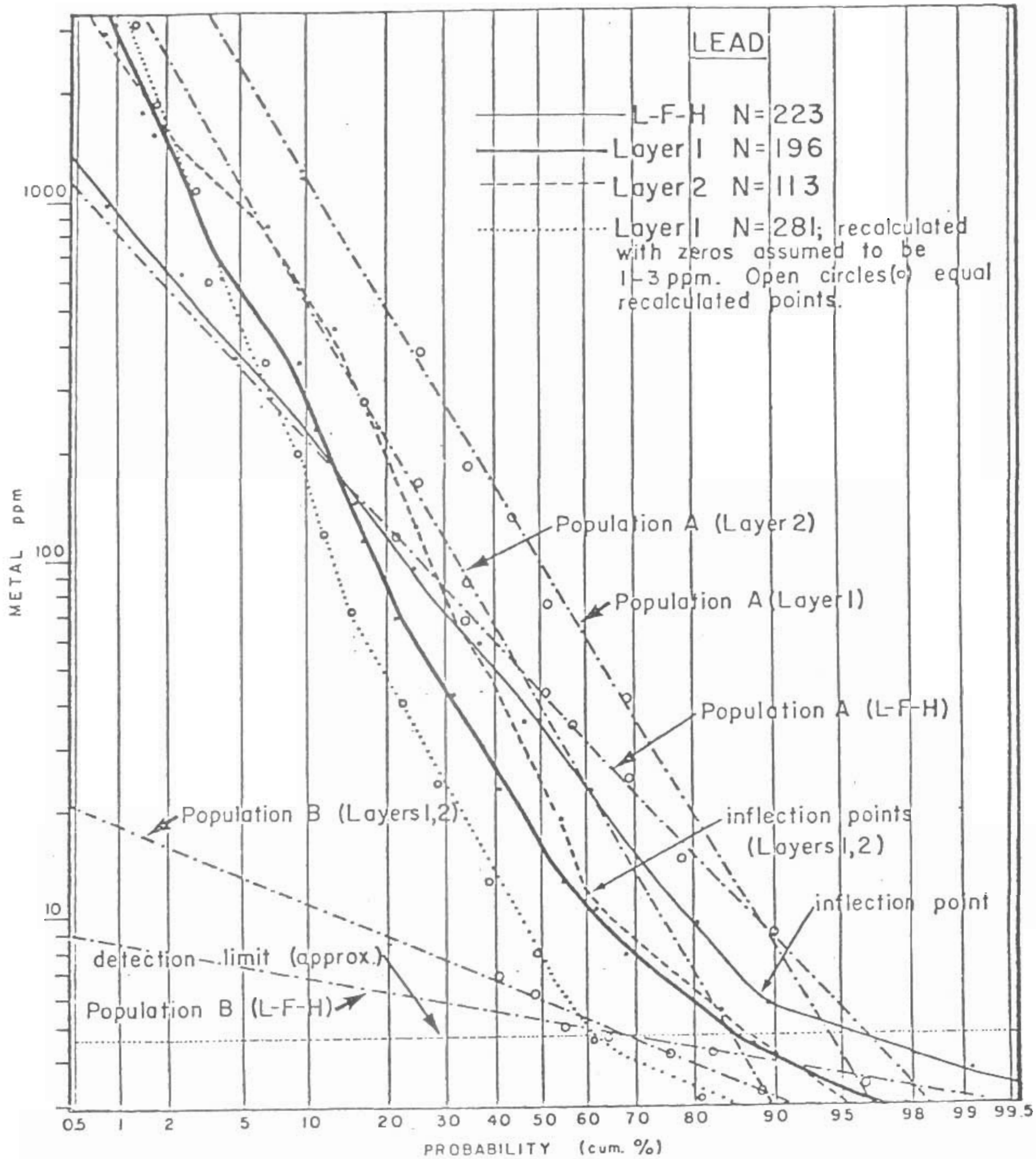

Figure 24. Log probability plot of Pb, -80 mesh fraction, total attack. See Fig. 21 for explanation of symbols.

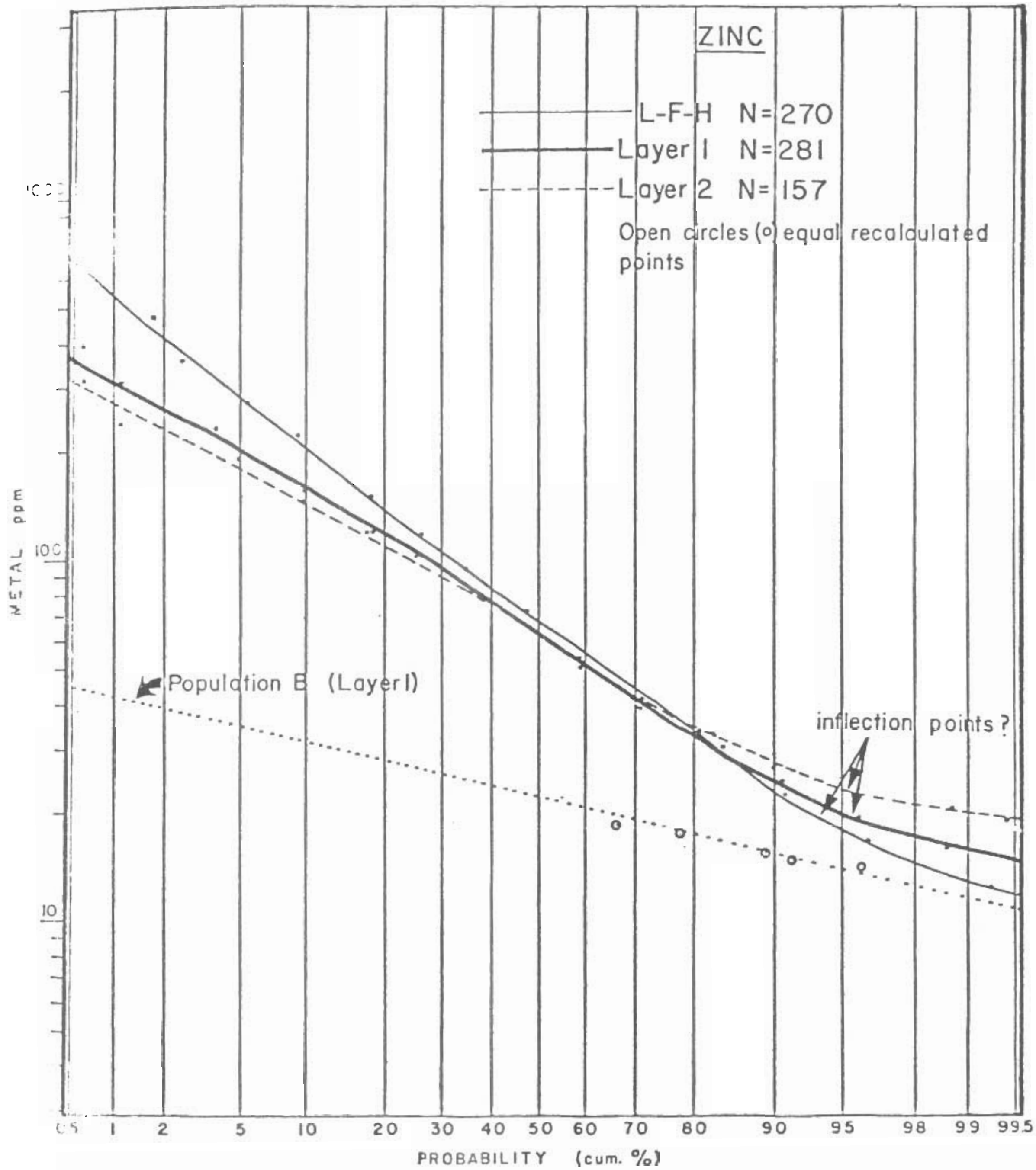

Figure 25. Log probability plot of Zn, -80 mesh fraction, total attack. See Fig. 21 for explanation of symbols.

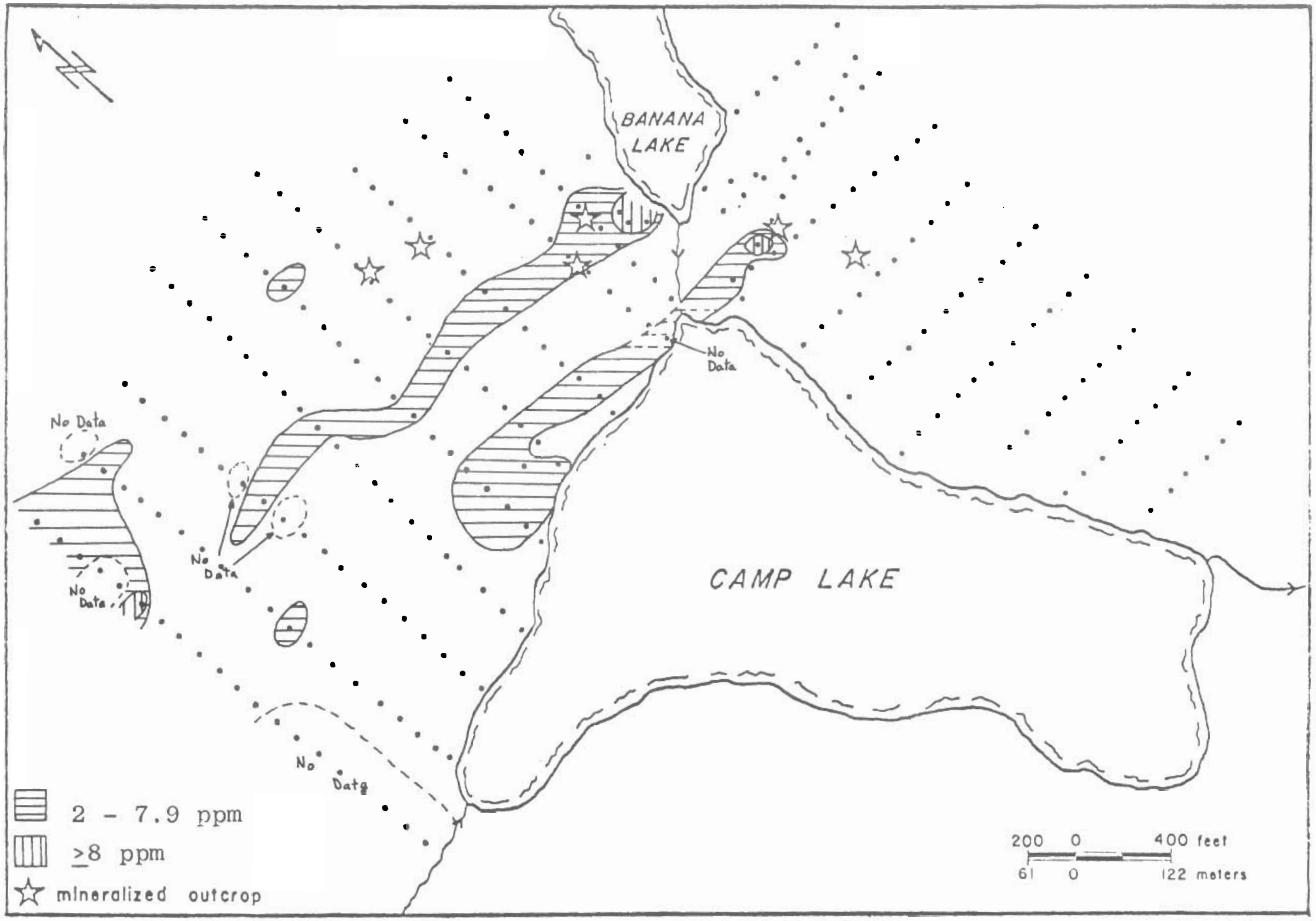

Figure 26. Camp Lake: Ag content of the L-F-H horizon, -80 mesh, total attack.

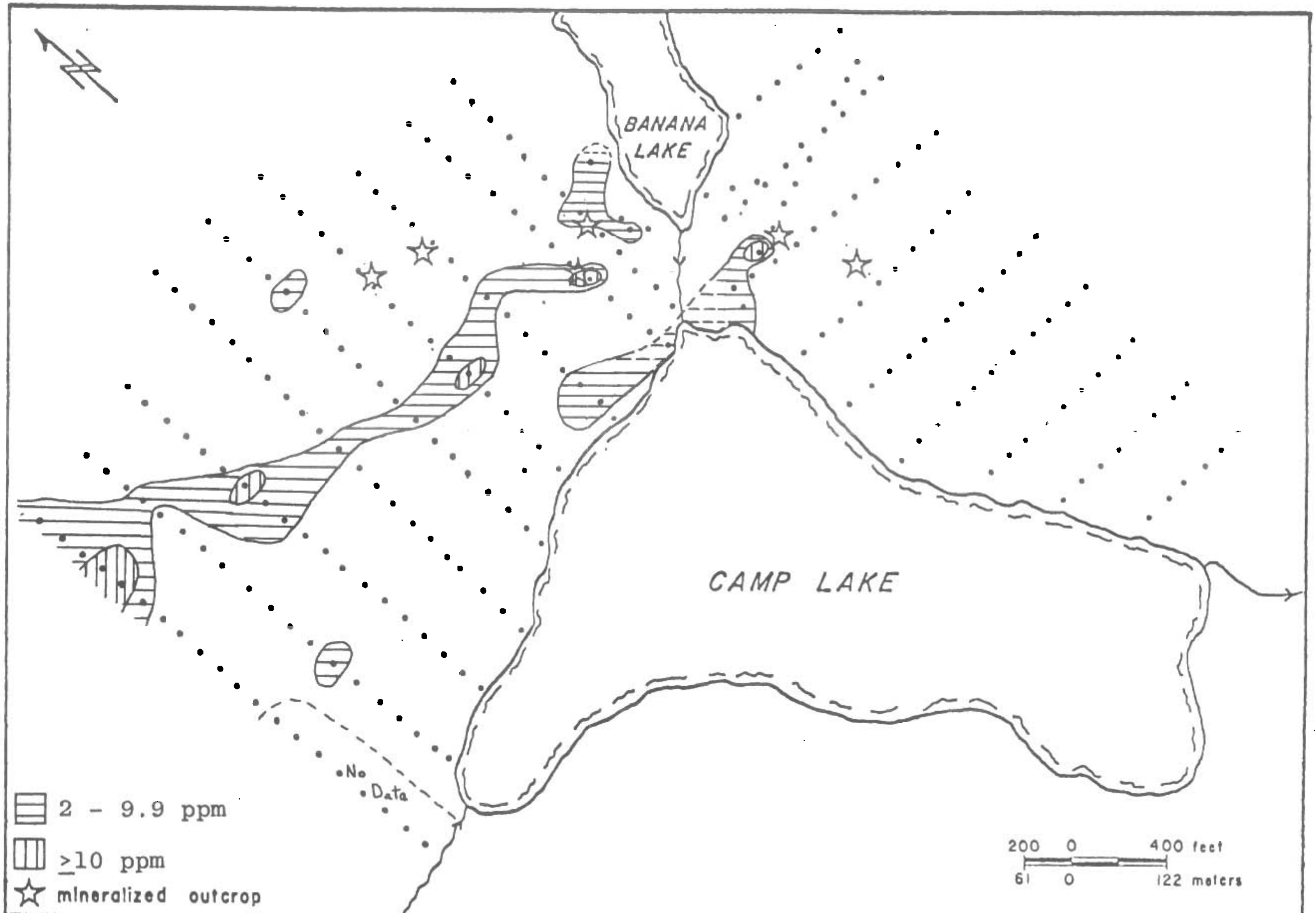

Figure 27. Camp Lake: Ag content of Layer 1 soils, -80 mesh, total attack.

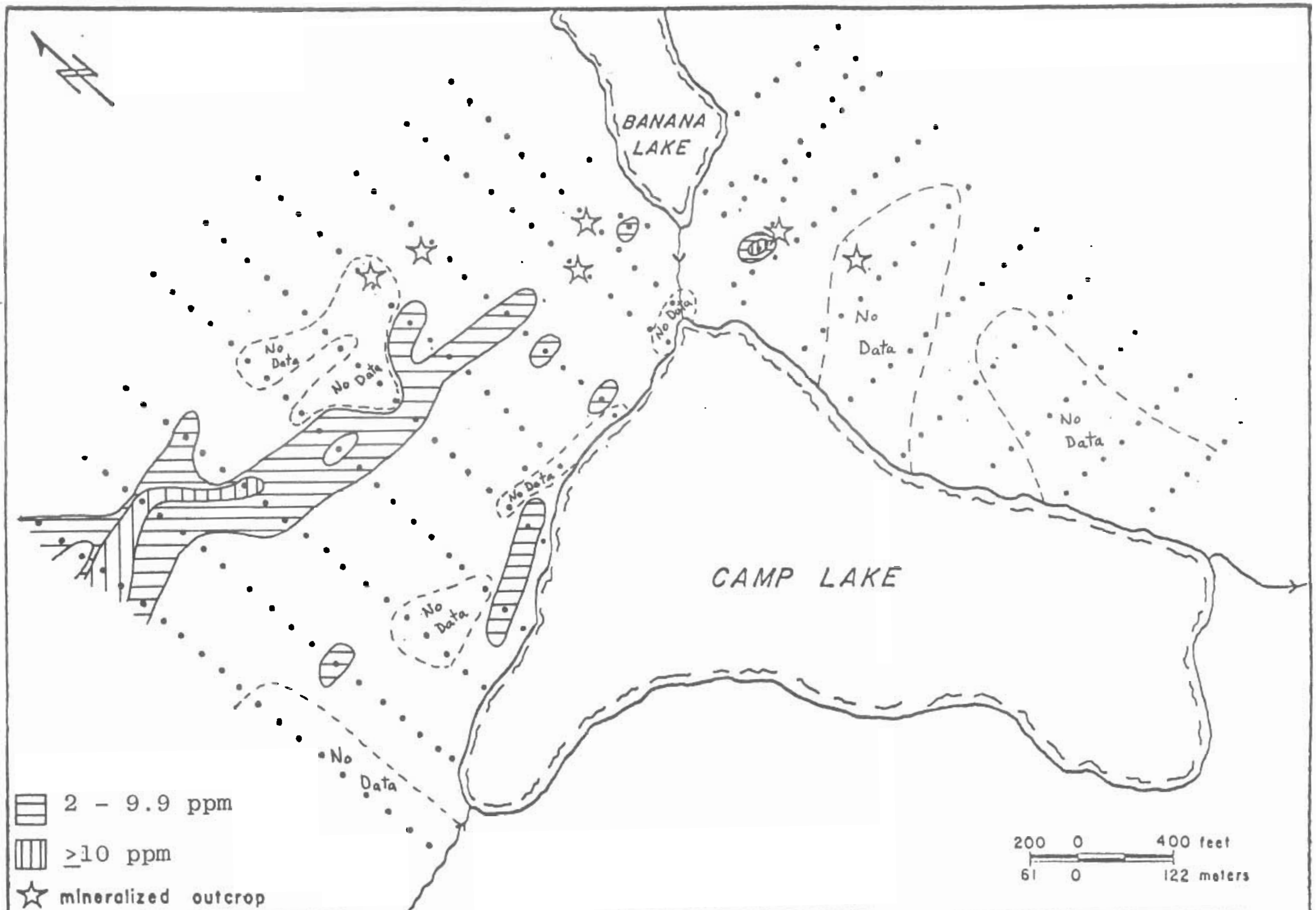

Figure 28. Camp Lake: Ag content of Layer 2 soils, -80 mesh, total attack.

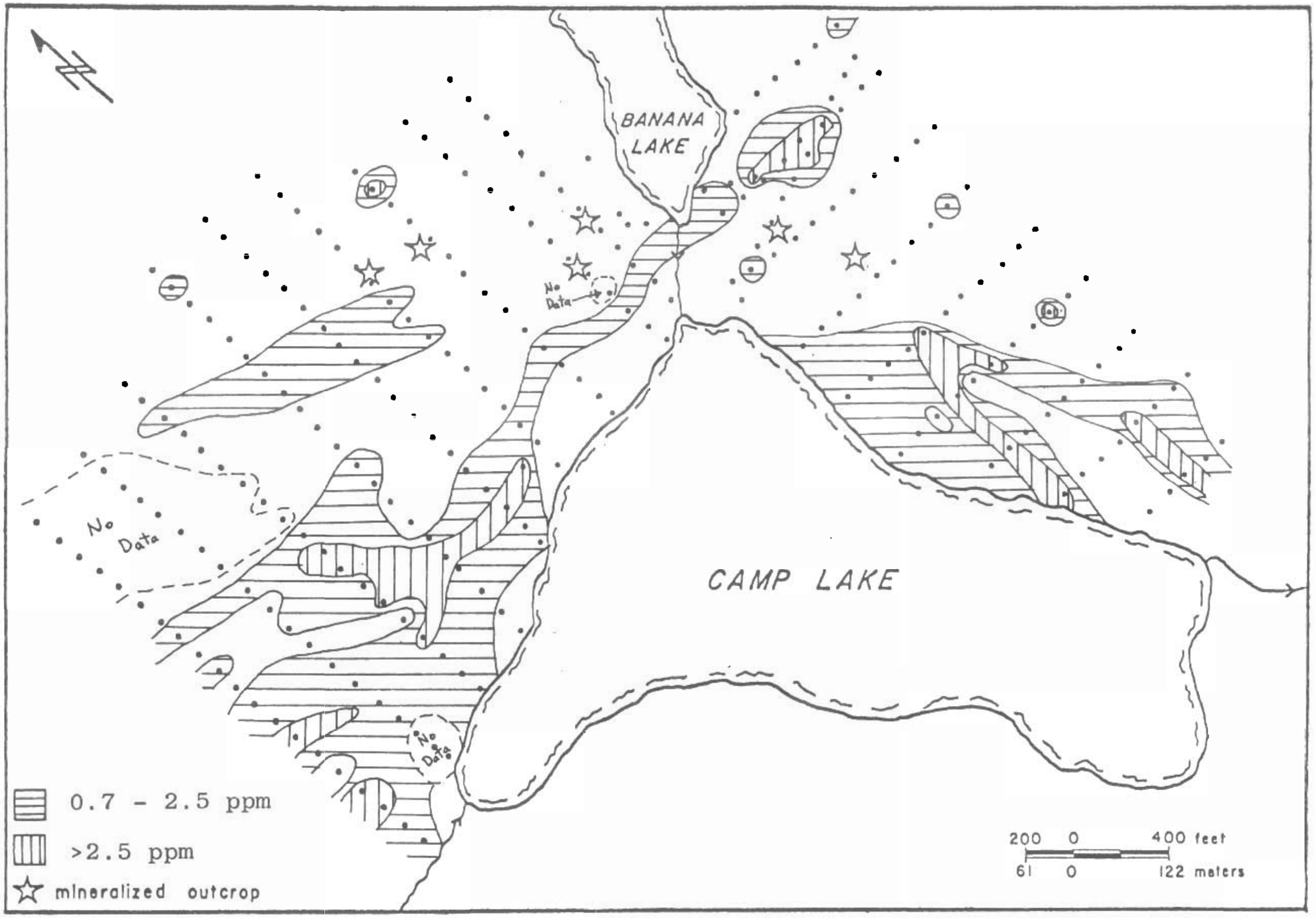

Figure 29. Camp Lake: Cd content of the L-F-H horizon, -80 mesh, total attack.

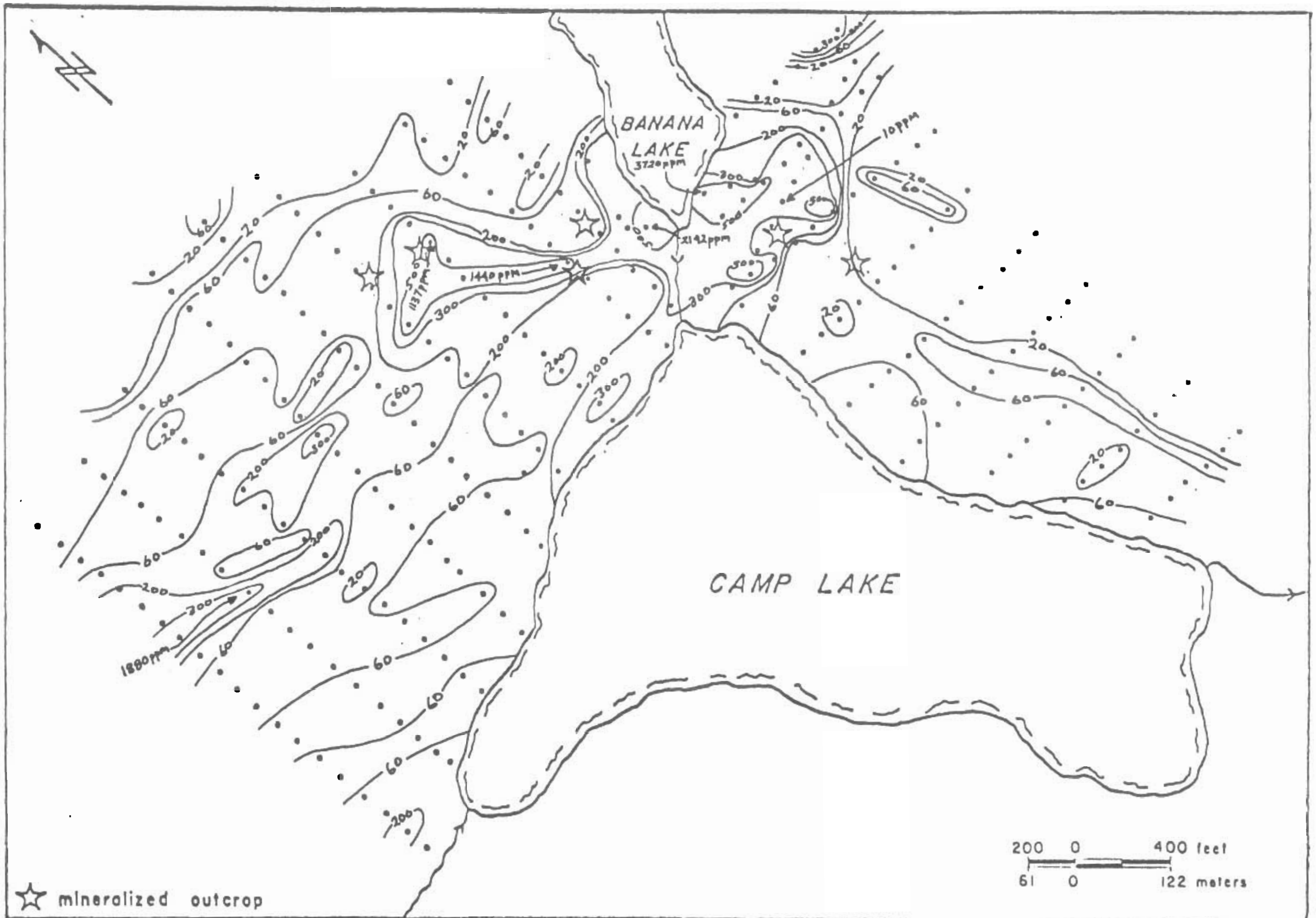

Figure 30. Camp Lake: Cu content (ppm) of the L-F-H horizon, -80 mesh, total attack.

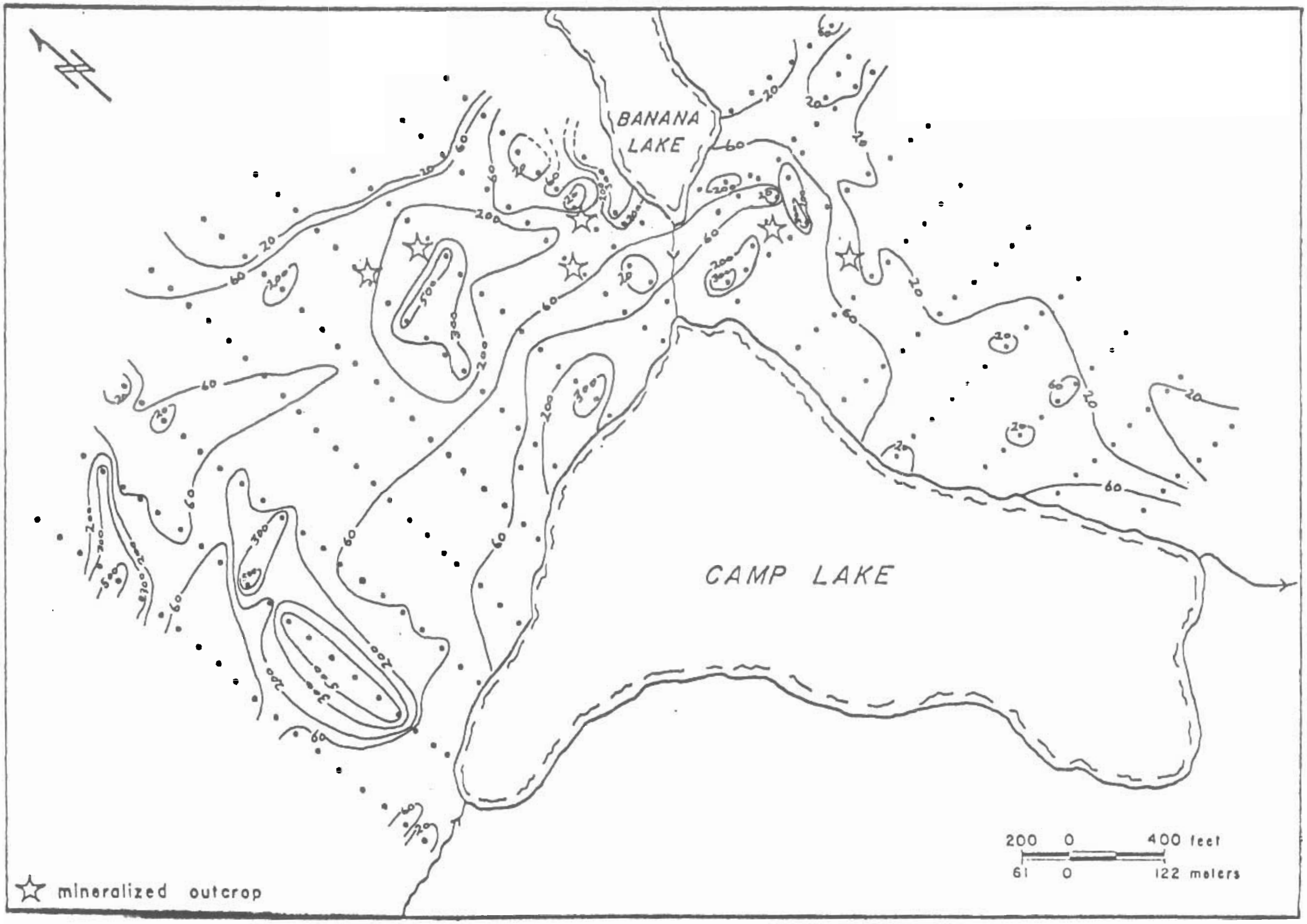

Figure 31. Camp Lake: Cu content (ppm) of Layer 1 soils, -80 mesh, total attack.

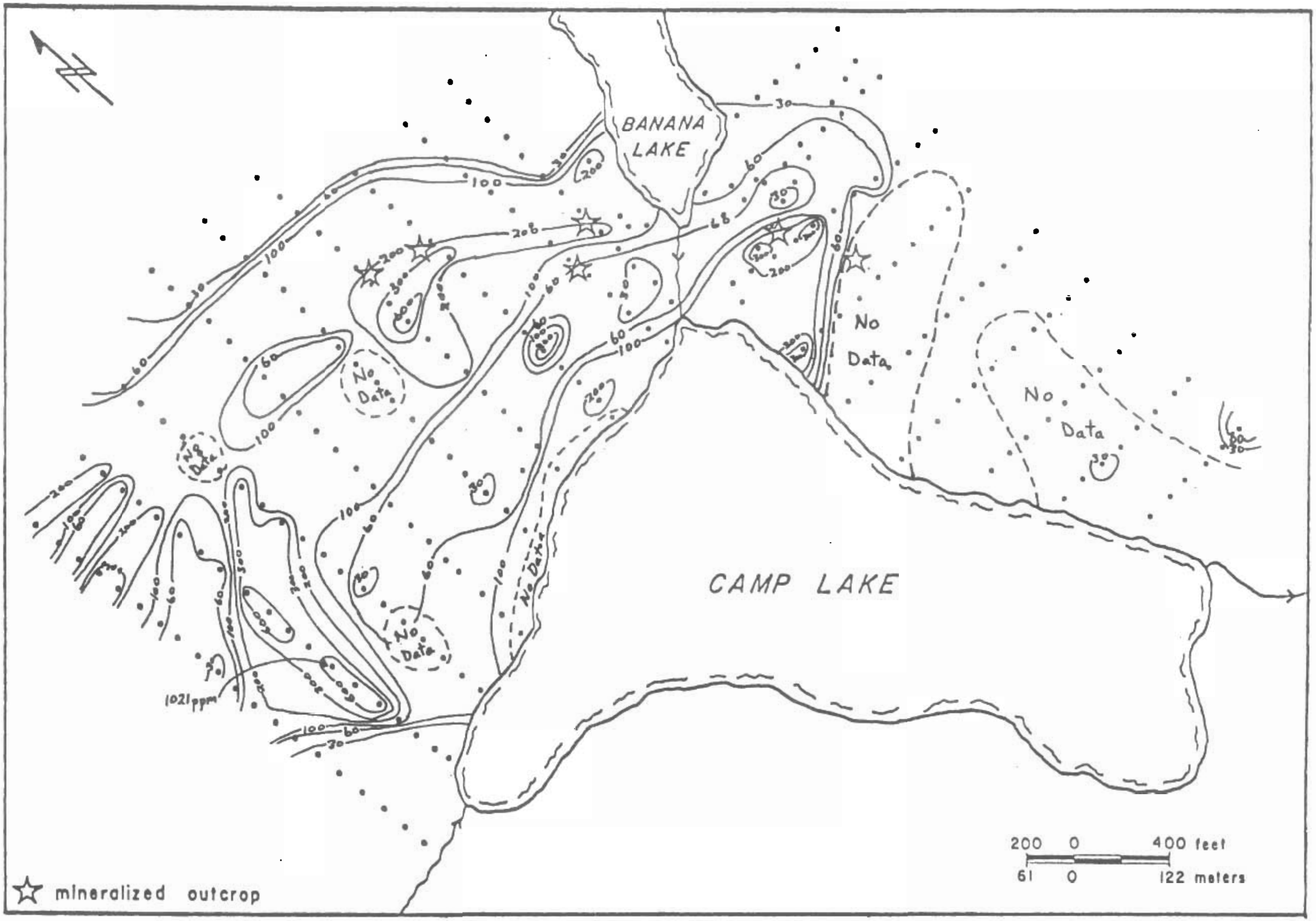

Figure 32. Camp Lake: Cu content (ppm) of Layer 2 soils, -80 mesh, total attack.

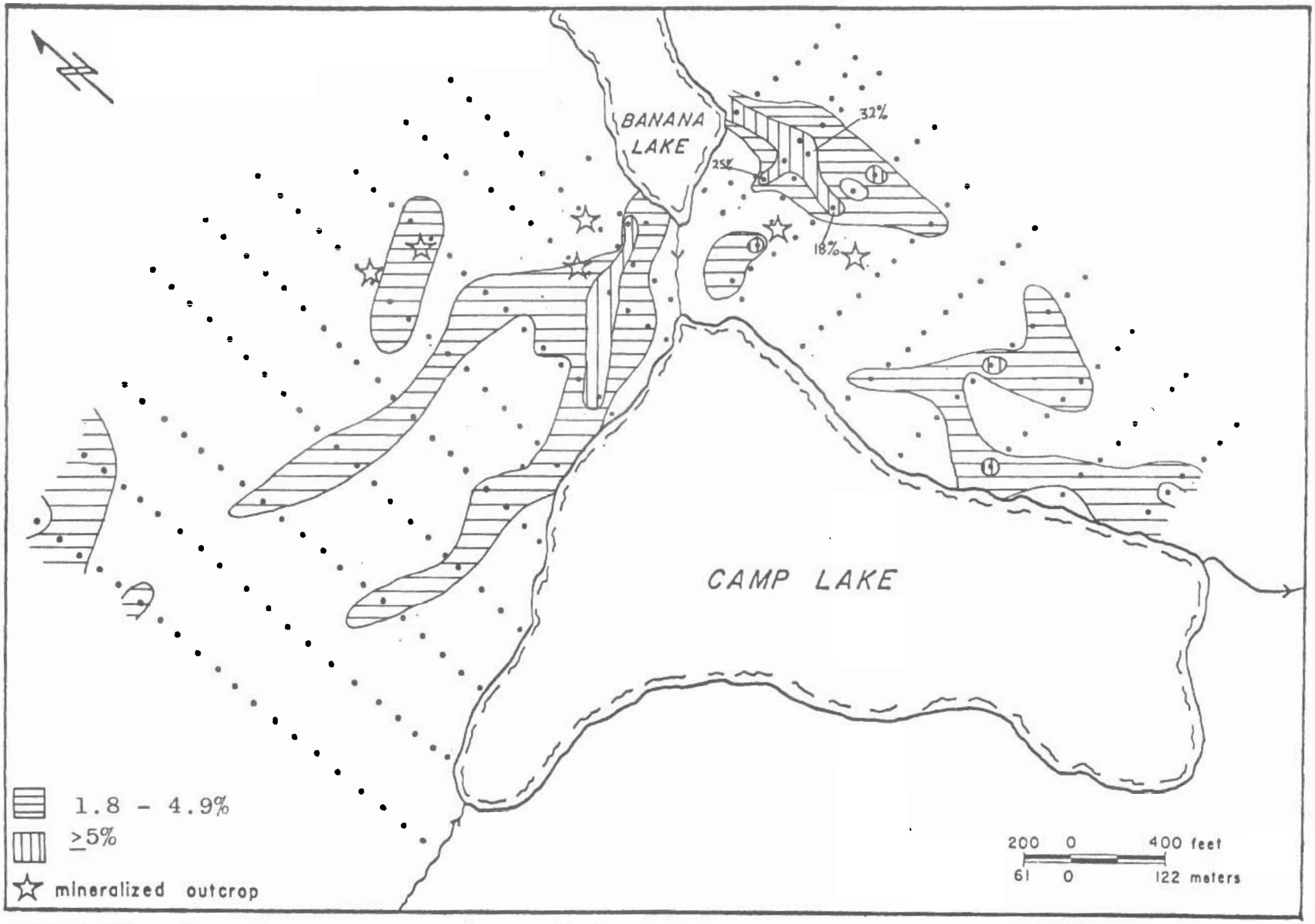

Figure 33. Camp Lake: Fe content of the L-F-H horizon, - 80 mesh, total attack.

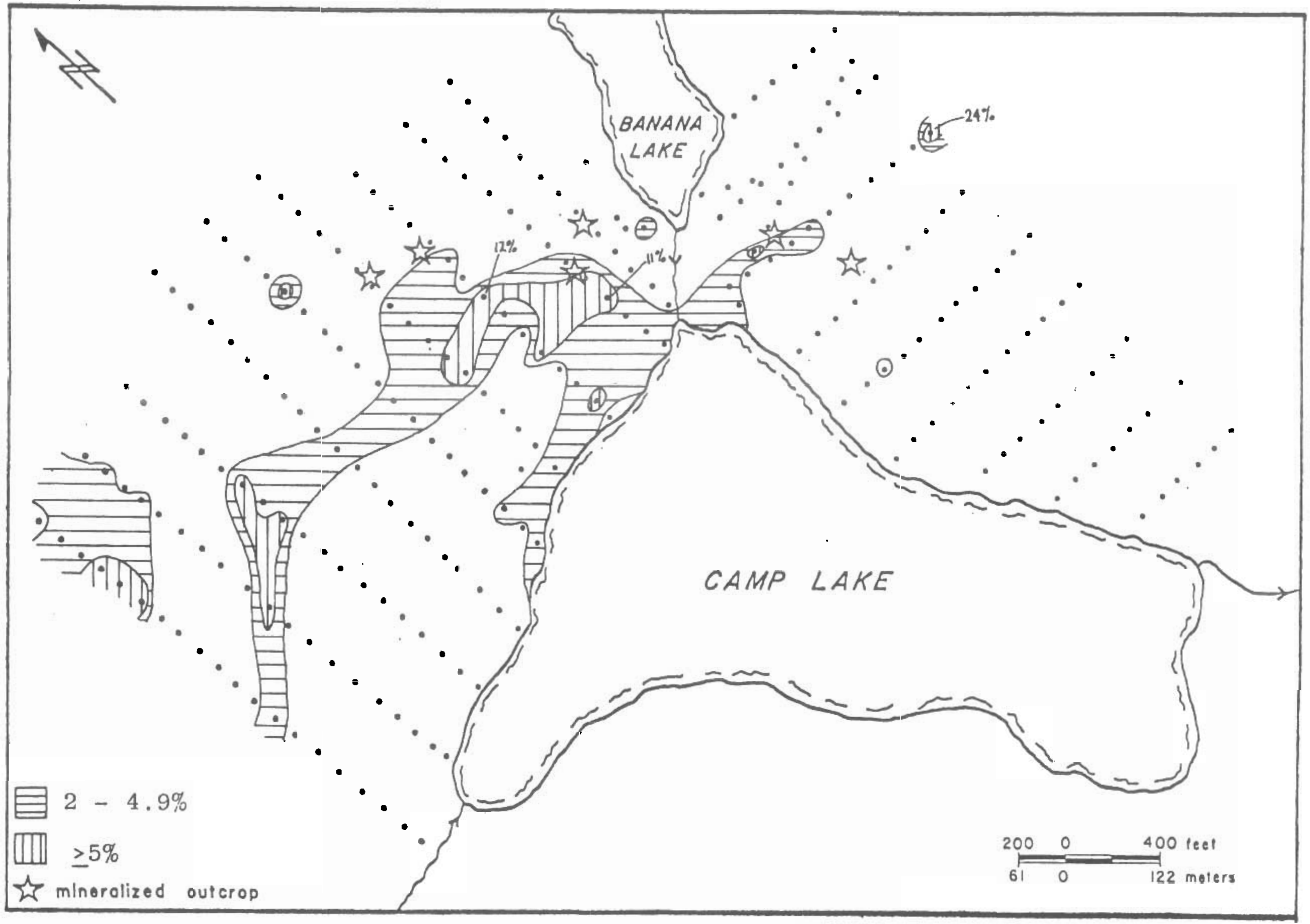

Figure 34. Camp Lake: Fe content of Layer 1 soils, -80 mesh, total attack.