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by

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Abstract

Analysis of heavy minerals from placer pan concentrates confirmed that tin and tungsten minerals are associated with specific Devonian quartz monzonite and alaskite plutons.

Introduction

Certain high-level, post-orogenic Devonian granite plutons of the Hayesville map-area were found during regular 1-mile scale bedrock geological mapping in 1959 and 1960 to contain wolframite, molybdenite and fluorite. Other plutons appear megascopically similar in some localities. Placer pan concentrates were collected from stream sand and gravel, treated and analysed by X-ray fluorescence (XRF). The resulting data confirmed the field indentification of the enriched plutons.

Geological Setting

Hayesville and Napadogan map-areas lie on the southeast side of the Miramichi Anticlinorium, where the Lower and Middle Ordovician Tetagouche Group is bordered to the southeast by Silurian turbidites and to the north by Ordovician cataclastic granitic rocks (Fig. 1) (Poole, 1958, 1960, 1963; Anderson and Poole, 1959). The lower part of the Tetagouche Group consists of grey slate, phyllite and orthoquartzite, metamorphosed to schist near the cataclastic granites. The upper part of the Group consists of red manganiferous slate and graphitic ribbon chert inter-layered with basaltic sills, flows and pyroclastic rocks, all overlain by thick greywacke and slate. Barren Ordovician granite plutons, possibly sub-volcanic to the Tetagouche volcanics, were penetratively deformed in late Ordovician time. The Silurian greywacke and slate appear to be everywhere faulted against the Ordovician rocks.

Most of the post-orogenic Devonian plutons consist of pink and grey biotite quartz monzonite and biotite-hornblende granodiorite with narrow hornfelsed contact aureoles (Dg1). An apparently younger Devonian granite (Dg2) is interpreted as a high-level, partly unroofed, steep-walled intrusion with a undulating top and an extensive contact aureole. The several areas of outcrop are believed to be upward protrusions from this body. The Dg2 granite has accessory fluorite, quartz-fluorite veins, molybdenite-wolframite-quartz veins, and local greisen zones. Cassiterite is a minor constituent along with a variety of minerals in the molybdenite-wolframite-quartz veins of the Burnt Hill deposit (Victor, 1957).

Glacial striae and lineated terrain suggest that the last glaciers moved southeast and east across the area (Fig. 2). Most major streams flow easterly.

Method

The concentrates were collected in a non-systematic, non-rigorous fashion at easily accessible localities (Fig. 2) by field assistants with little training in sample selection and panning technique. Generally two pans of sand and gravel were panned at each site and combined to produce a concentrate. 81 concentrates were collected in Hayesville map-area and 26 in Napadogan map-area.

In the laboratory in 1961, the following tests on each concentrate were carried out in sequence:

1. Ultraviolet lamp (mineralight). Scheelite and zircon were noted in most concentrates and identities of a few grains were confirmed by X-ray diffraction.

2. End window β counter (background 85-90 counts per minute). Two concentrates had counts of 155 counts per minute, almost twice background. Figure 11 shows the counts above background grouped in 4 intervals. A standard sample containing 0.10% U_3O_8 yielded 530 counts per minute.

3. Hand magnet. Magnetic minerals were drawn off by a hand magnet and bottled.

4. Heavy liquid separation of non-magnetic fraction.
   a) Bromoform, specific gravity of about 2.90. Light minerals, e.g. quartz and feldspar, were floated, washed and bottled.
   b) Methylene iodide, specific gravity of about 3.30.
      i. Intermediate minerals, e.g. amphiboles and epidote, were floated, washed and bottled.
      ii. Heavy minerals, e.g. scheelite, wolframite and cassiterite, in the sink fraction were washed and bottled.

5. X-ray fluorescence analysis of heavy minerals of the methylene iodide sink fraction. The heavy mineral fraction was analysed in a sample holder in its raw state without fluxes using an instrument scanning rate of 2 degrees per minute. The intensity (or amplitude) of a selected peak specific to the element was recorded. Those sink fractions too small to cover the sample holder surface yielded anomalously low intensities. Correction factors were determined by analysing a range of sample sizes derived from a large sample. The fractions ranged from 0.01 to 3.6 gm. 6 fractions of less than 0.06 gm were not analyzed. For those from 0.06 to 0.25 gm, the X-ray intensities were multiplied by a correction factor ranging from 2.7 for a 0.06 gm fraction to 1.2 for a 0.25 gm fraction. The intensities for fractions weighing more than 0.25 gm were left

unchanged. In this fashion, 55 analyses were approximately corrected for low weights.

The analysed elements are tin, tungsten, chromium, zirconium, yttrium, titanium, iron and manganese. The relative content of each element in the methylene iodide sink fraction is plotted on figures 3 to 10 by grouping the X-ray intensities into 8 to 11 intervals.

Results

The resulting plots must be viewed as indicative only. Variations in sampling, panning and X-ray analysis produced only relative elemental values. Thus, caution must be exercised in comparing analyses of the same element from concentrate to concentrate. No relation is intended from element to element within one concentrate. No quantitative implications can be assumed from the plots.

The tin and tungsten minerals (Fig. 3 and 4) are concentrated in streams draining younger Devonian quartz monzonite and alaskite (Dg2), thus supporting the geological conclusion that only this granite hosts these minerals. In outcrop, wolframite is the main tungsten mineral. Cassiterite was not identified in the field and must occur in tiny to microscopic crystals. Chromium distribution (Fig. 5) seems unrelated to the mapped geology except for rather high values over the Silurian turbidites. Source of the chromium is unknown (although it may occur as heavy minerals in the Silurian greywacke). Zirconium distribution (Fig. 6) roughly parallels yttrium distribution (Fig. 7); most higher-than-normal values appear in concentrates draining granitic rocks of all ages, apparently reflecting accessory minerals. No explanation can be offered for the single high zirconium and yttrium concentrate on the Silurian greywacke. Titanium and iron (Fig. 8 and 9) distributions are similar and presumably reflect mainly ilmenite and pyrite. Manganese (Fig. 10) is concentrated mainly near the granitic terranes, and probably reflects manganese-bearing garnets from metamorphic rocks and possibly manganese oxide coating other heavy minerals. Radioactivity (Fig. 11) of untreated concentrates yields a non-diagnostic pattern although there is a weak correlation with zirconium, yttrium, tin and tungsten, i.e. those elements related to the granites.

References

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1959: Woodstock-Fredericton map-area, New Brunswick; Geological Survey of Canada, Map 37-1959.

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1958: Napadogan map-area, New Brunswick; Geological Survey of Canada, Map 11-1958.

1960: Hayesville and McNamee map-areas, New Brunswick; Geological Survey of Canada, Paper 60-15.

1963: Hayesville map-area, New Brunswick; Geological Survey of Canada, Map 6-1963.

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1957: Burnt Hill wolframite deposit, New Brunswick, Canada; Economic Geology, v. 52, no. 2, p. 149-168a.

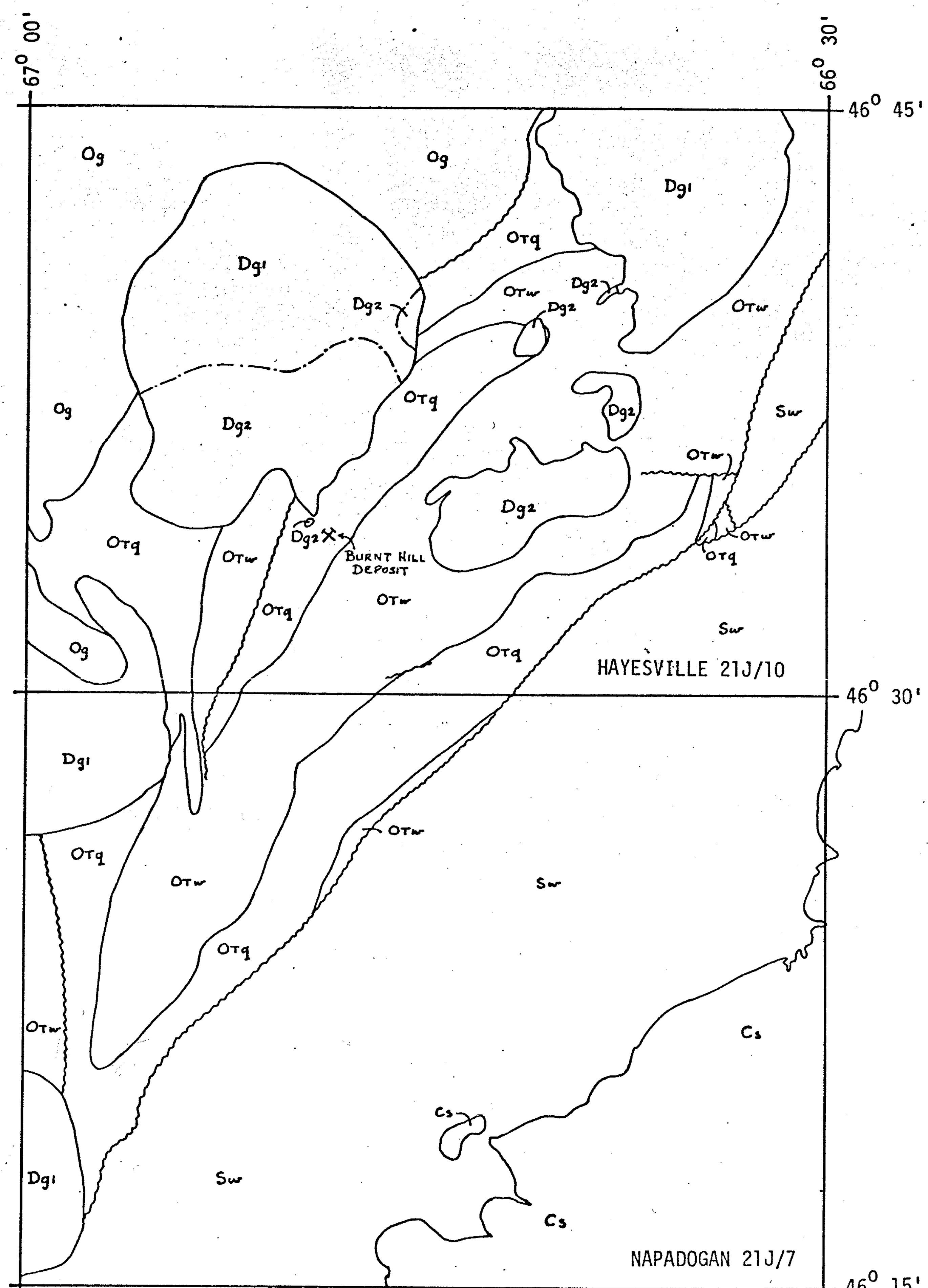

Figure 1. Generalized geology, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Otq - Tetagouche, lower: qte, sl, sch; Otw - Tetagouche, upper: Vb, sills, Mn-sl, graph sl, chert, gw, sl; Og - cataclastic gran; Sw - Sil. gw, sl; Dg1 Dev. gm.gd: Dg2-Dev.gm. Alask: Cs-Carb.ss,cg, local Vb

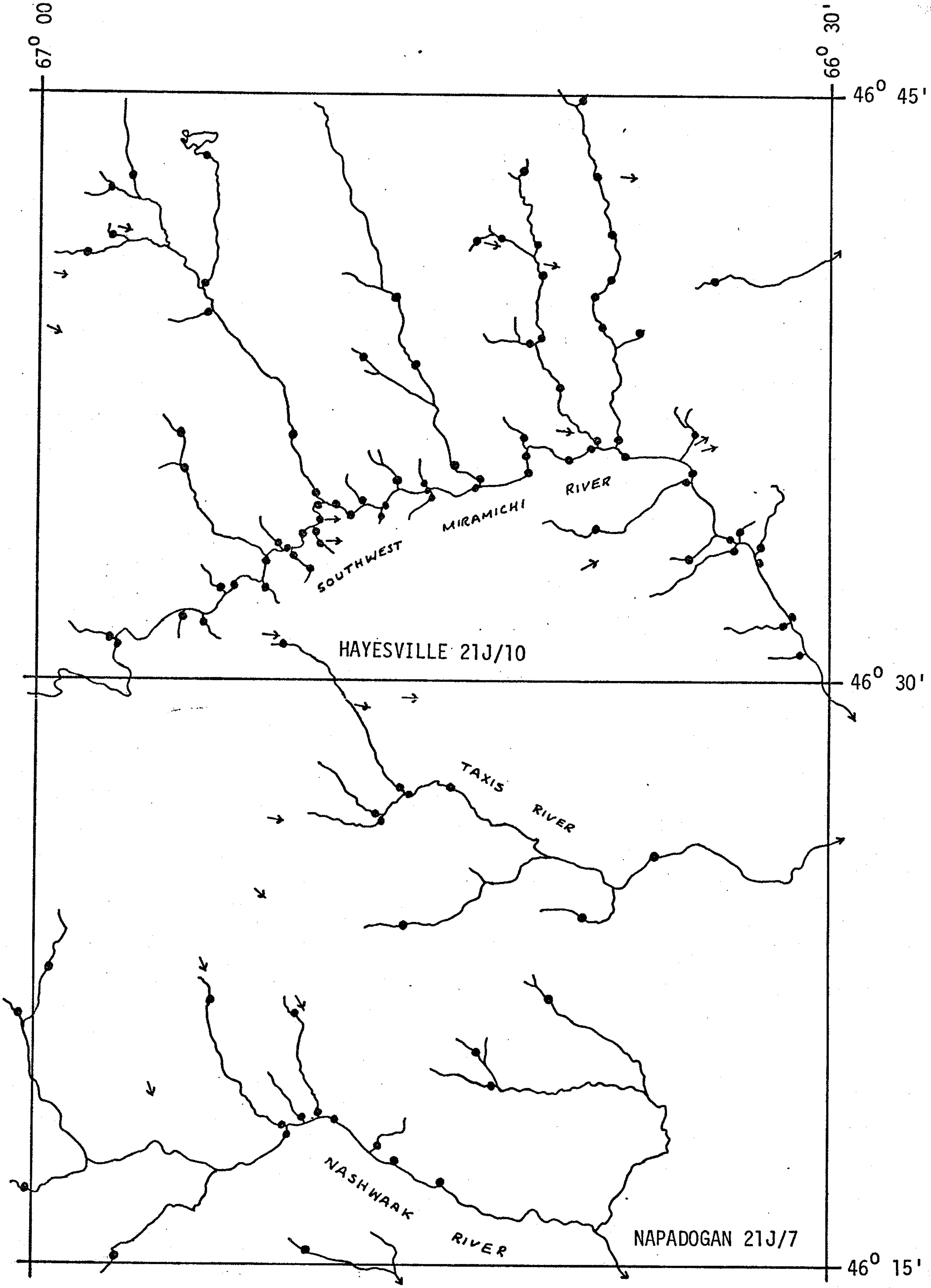

Figure 2. Locations of placer pan concentrates and selected glacial striae, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000.

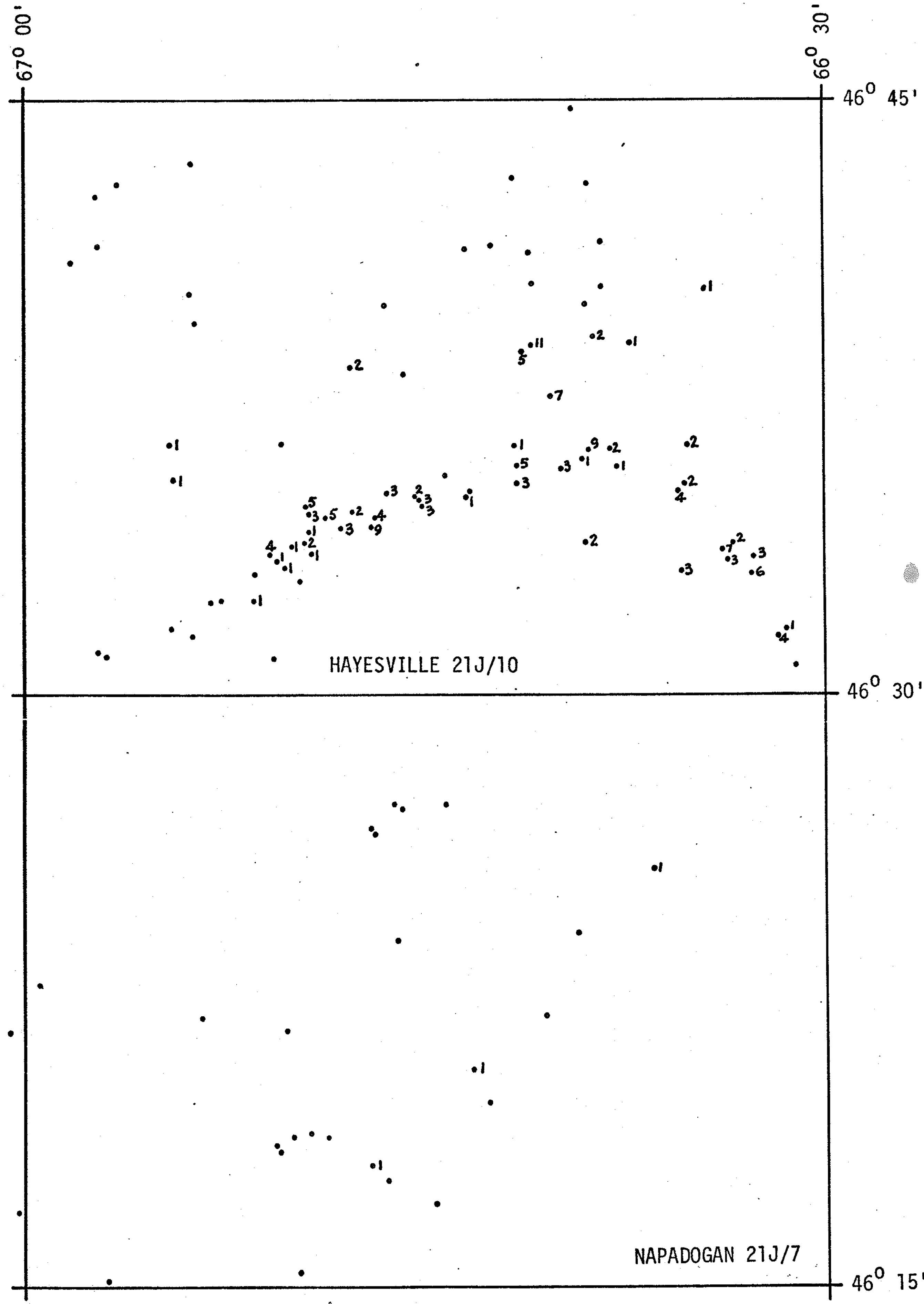

Figure 3. Tin in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Numbers - relative content of tin based on XRF intensities.

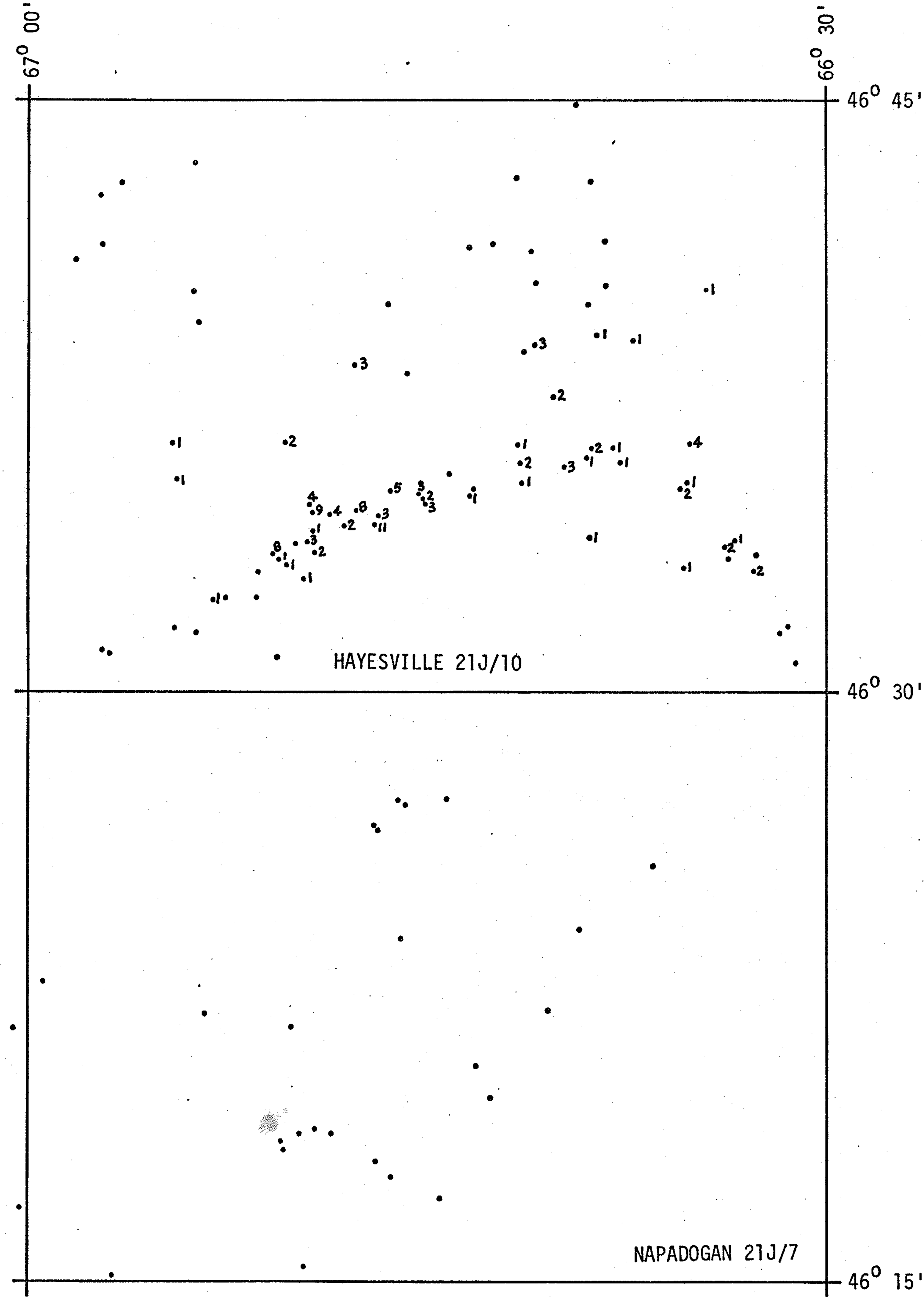

Figure 4. Tungsten in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Number - relative content of tungsten based on XRF intensities.

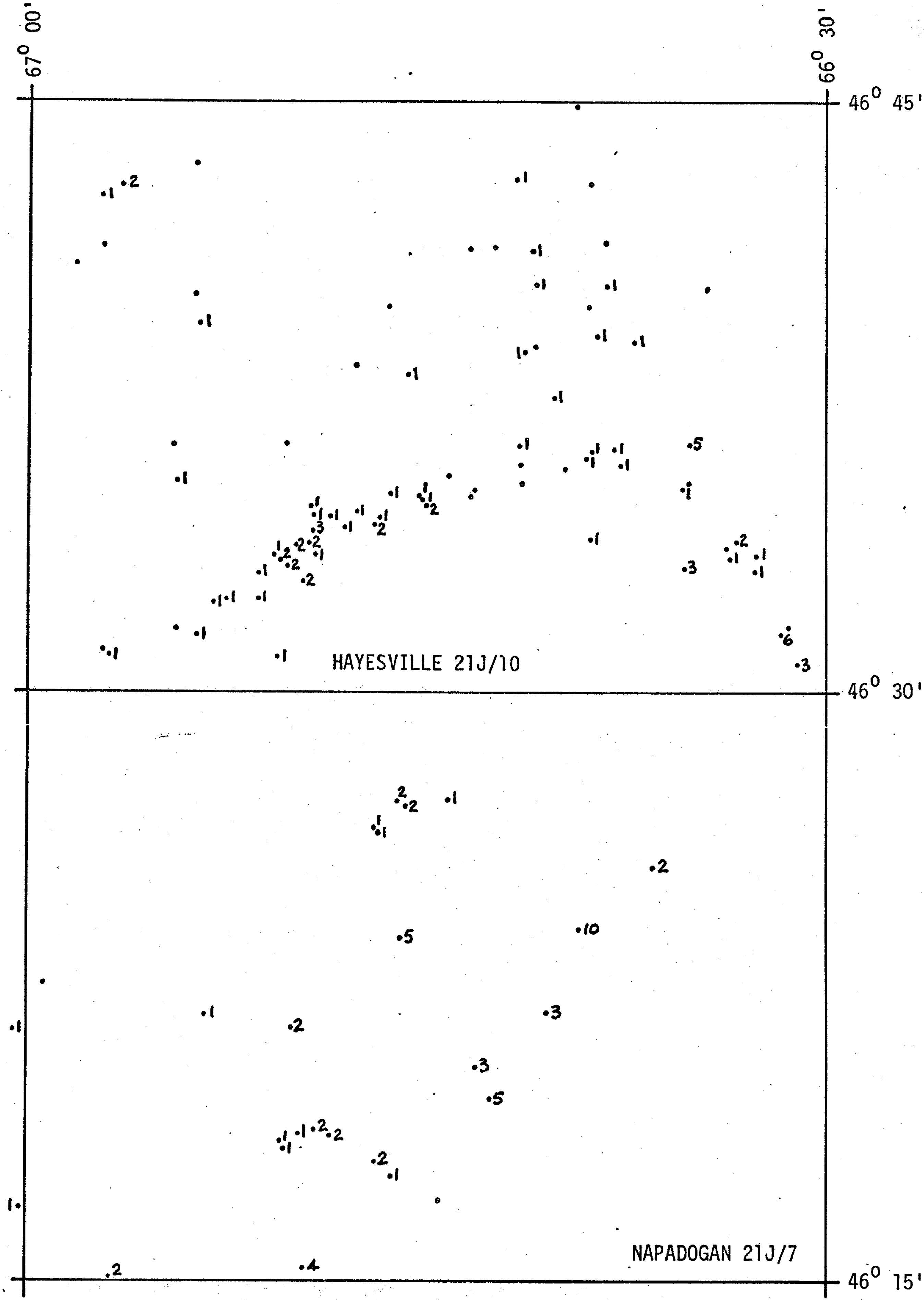

Figure 5. Chromium in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Numbers - relative content of chromium based on XRF intensities.

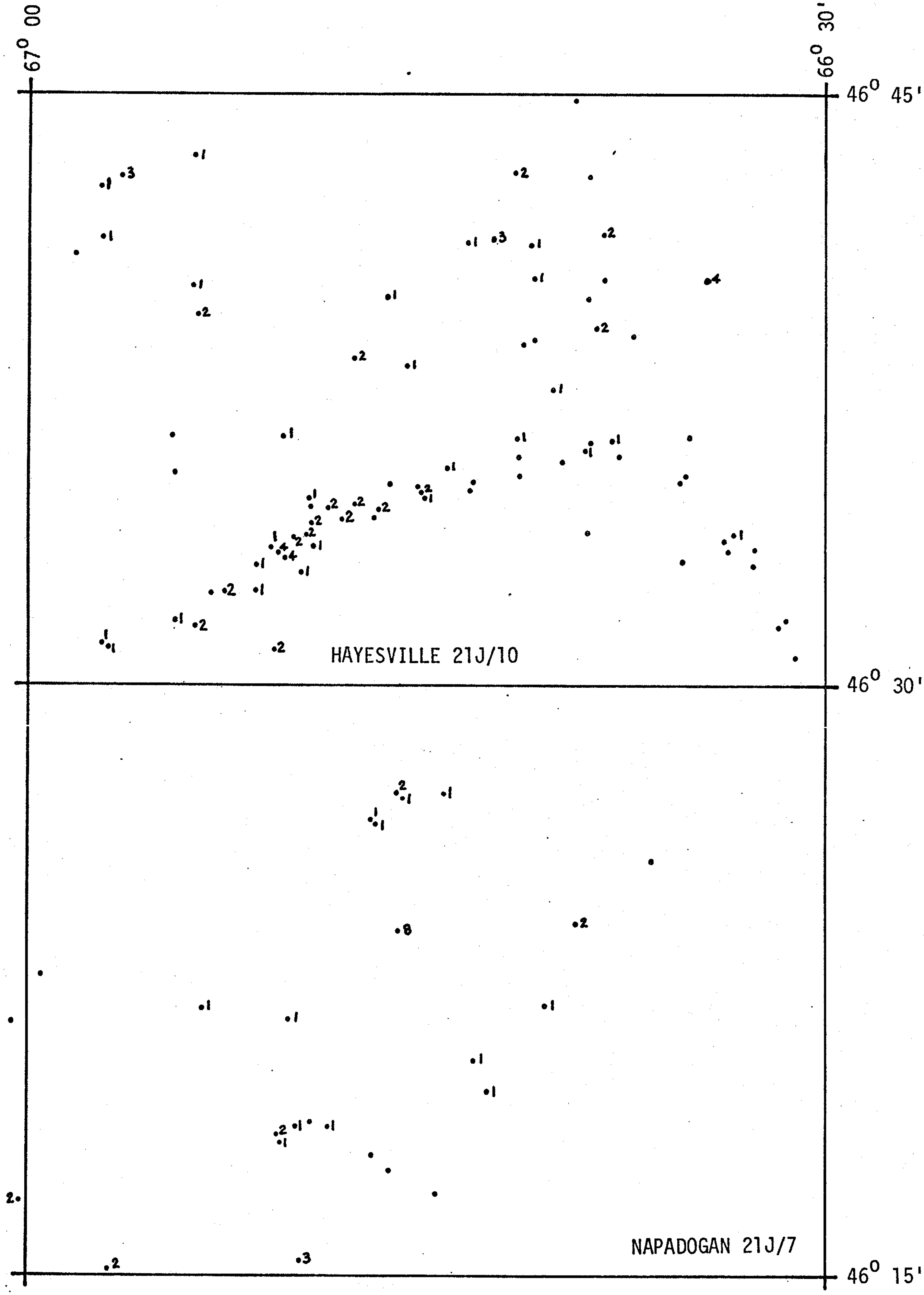

Figure 6. Zirconium in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Numbers - relative content of zirconium based on XRF intensities.

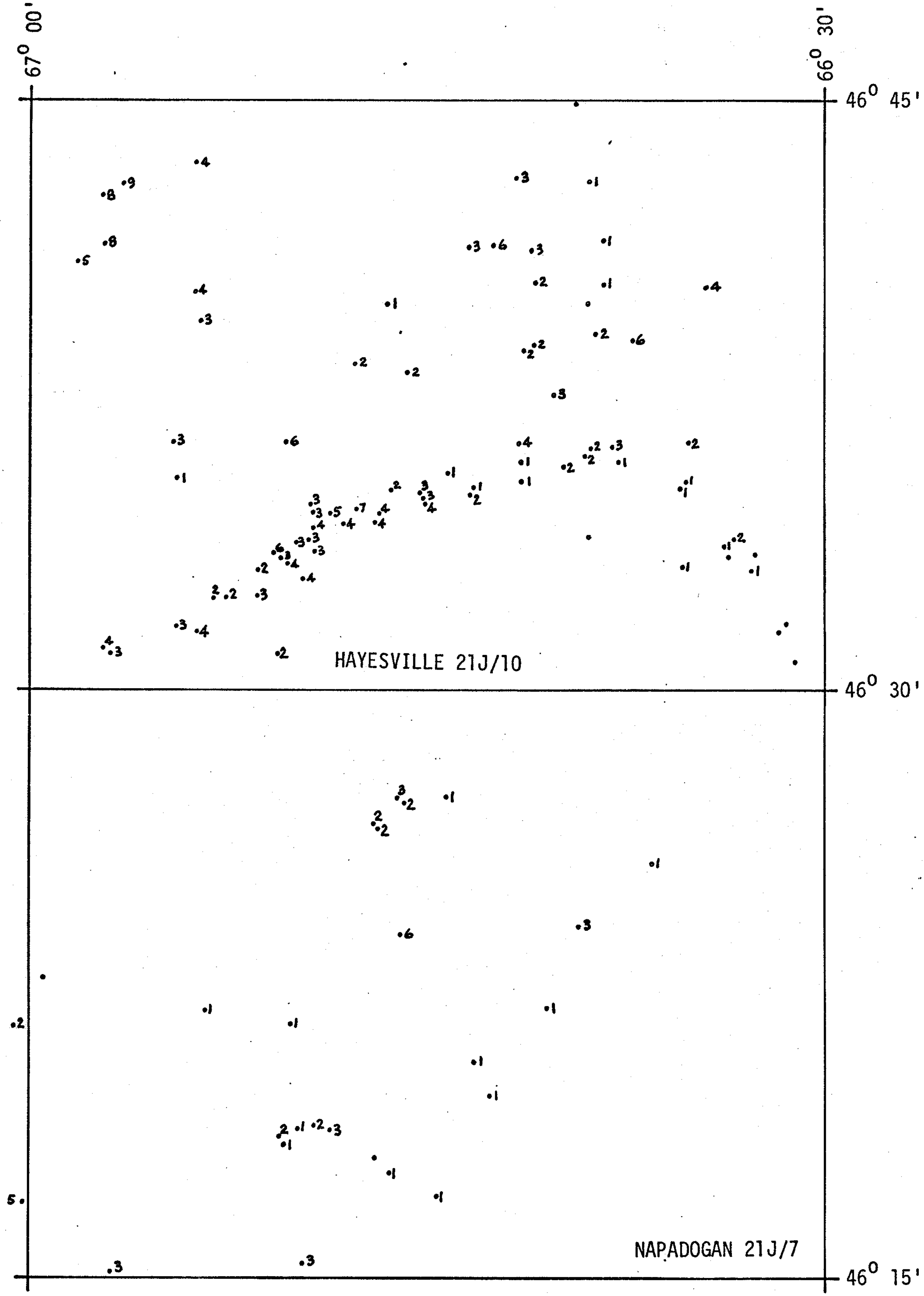

Figure 7. Yttrium in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Numbers - relative content of yttrium based on XRF intensities.

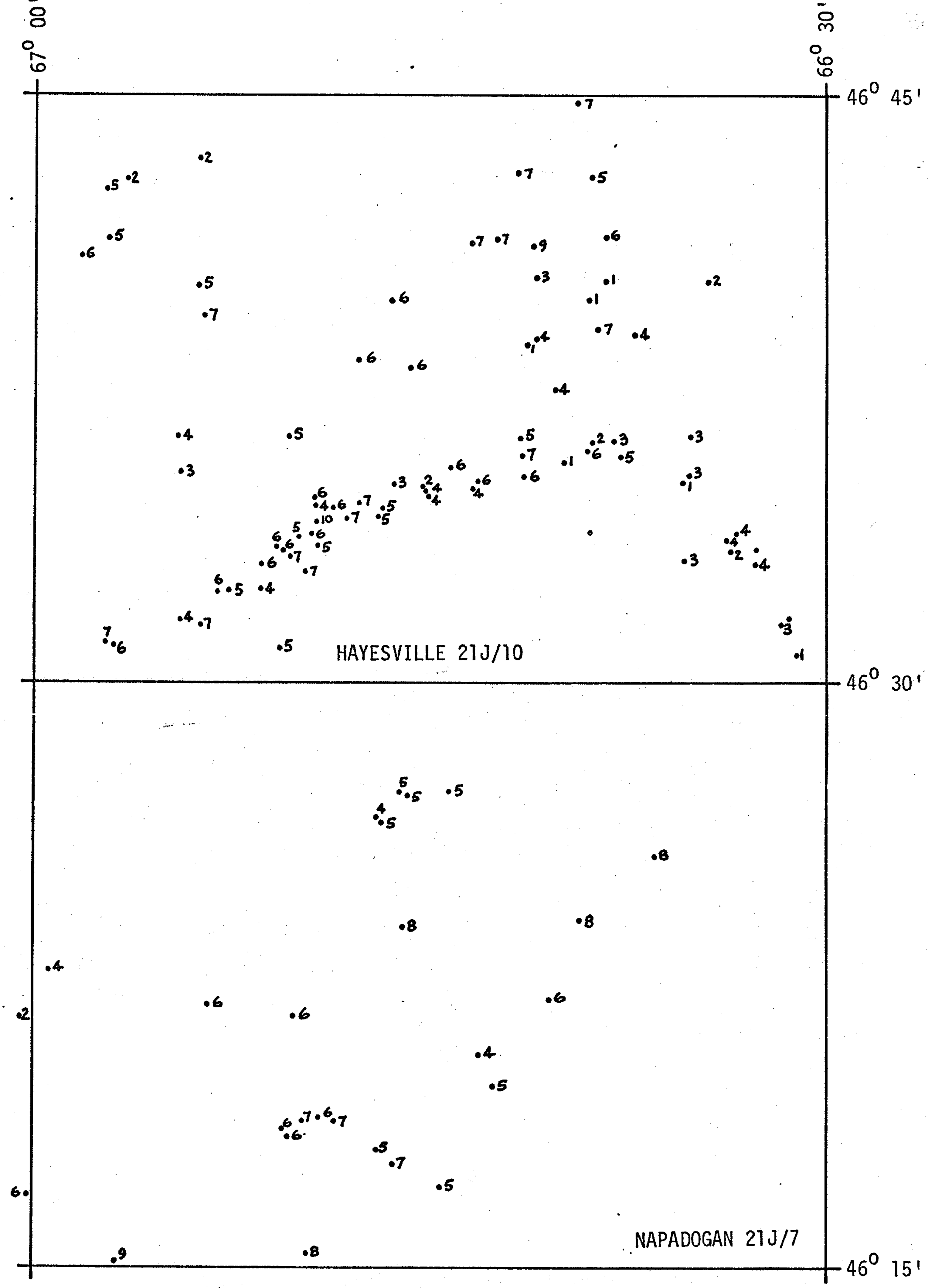

Figure 8. Titanium in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas. New Brunswick. Scale - 1:250,000. Dots - sample localities. Numbers - relative content of titanium based on XRF intensities.

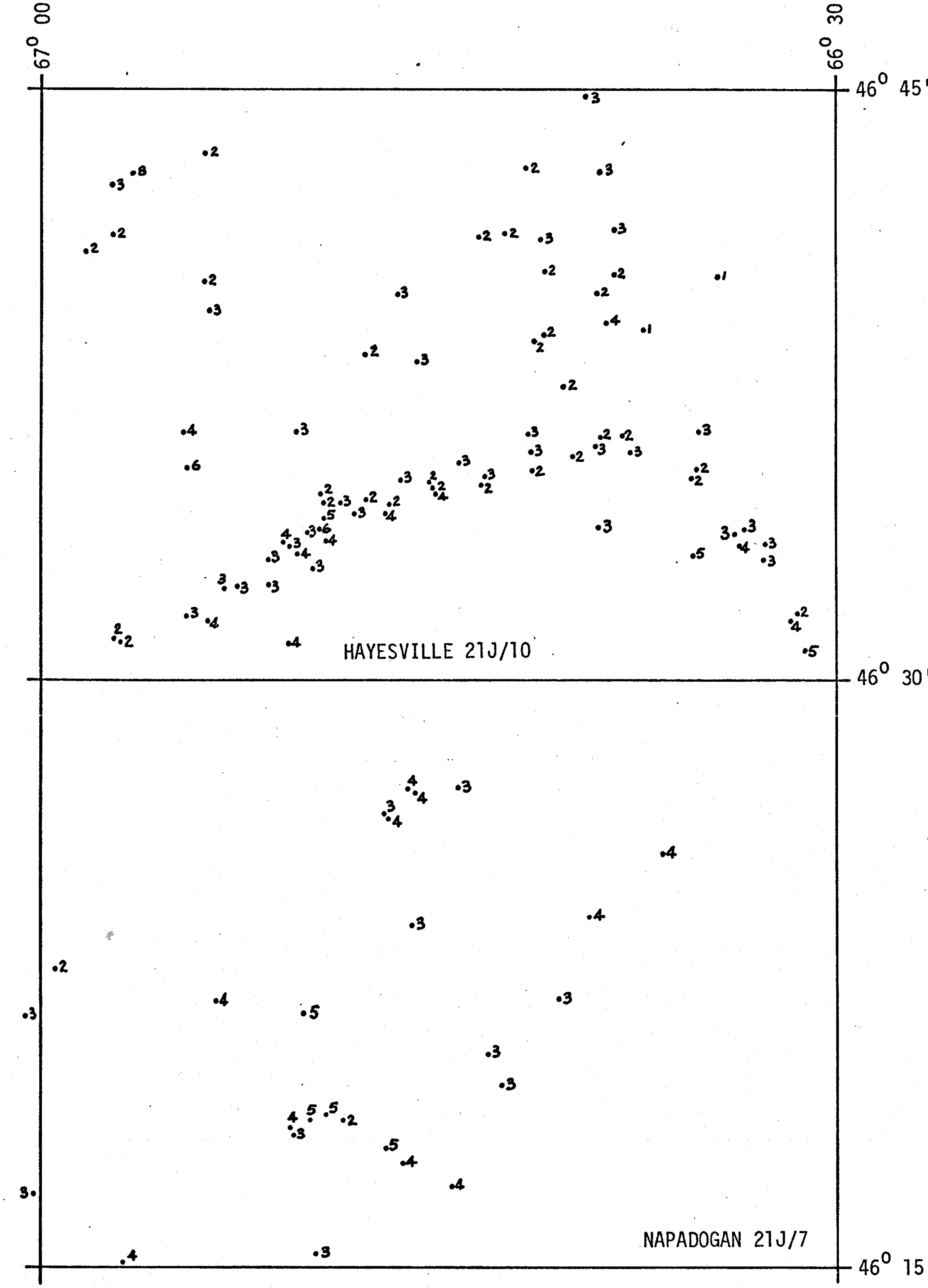

Figure 9. Iron in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Numbers - relative content of iron based on XRF intensities.

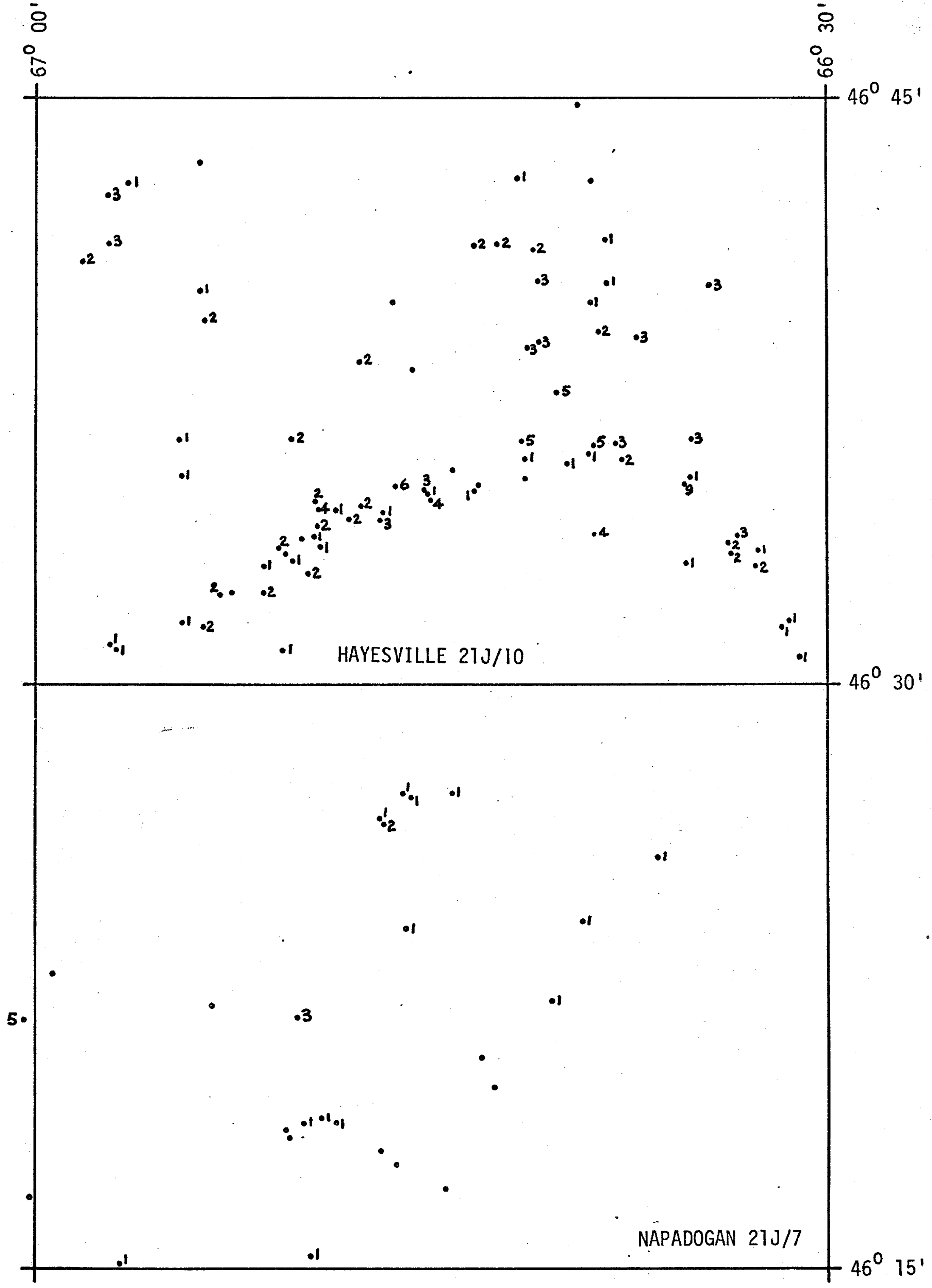

Figure 10. Manganese in non-magnetic, M.I. sink fraction of placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Numbers - relative content of manganese based on XRF intensities.

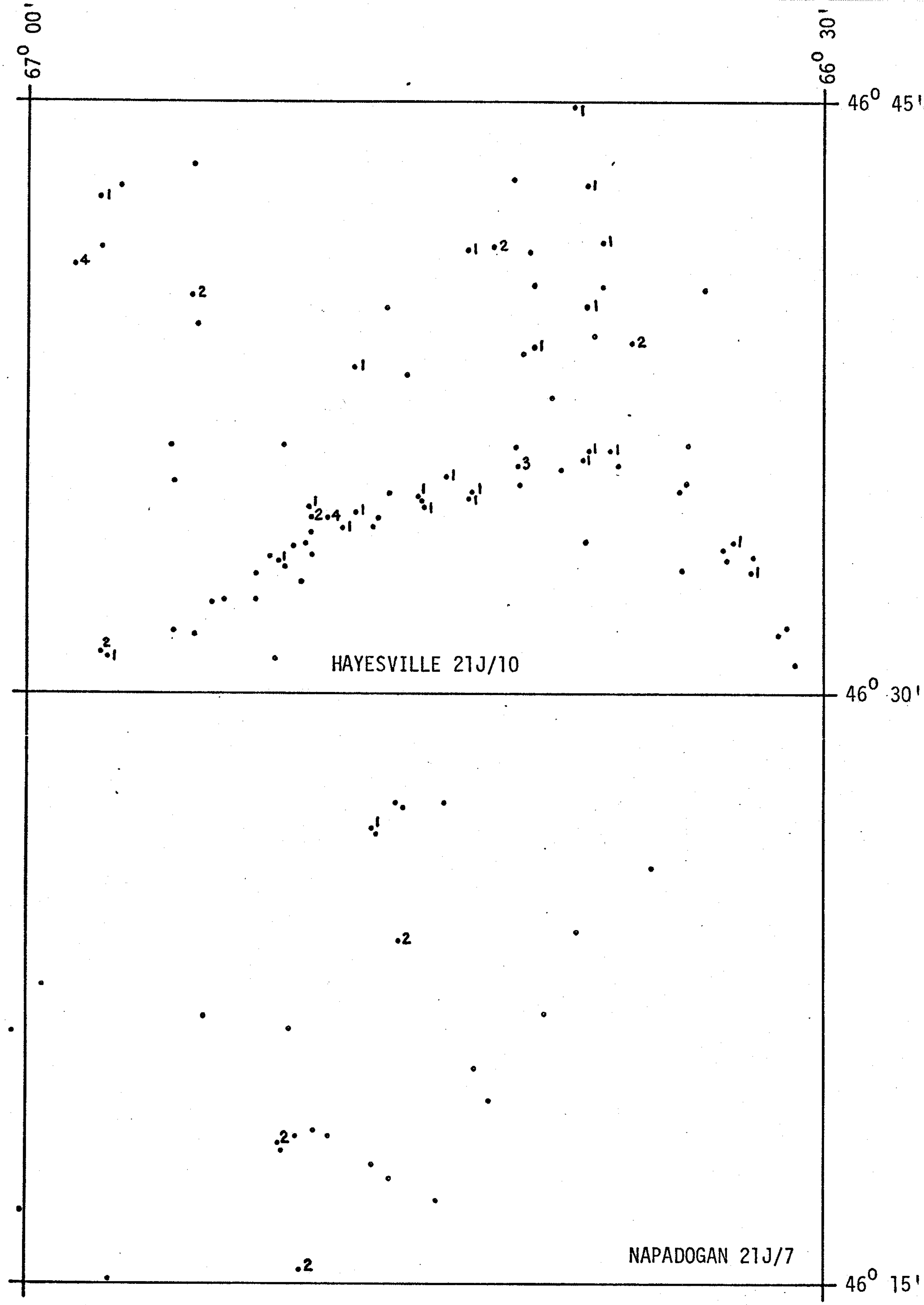

Figure 11. Radioactivity of untreated placer pan concentrates, Hayesville and Napadogan map-areas, New Brunswick. Scale - 1:250,000. Dots - sample localities. Number - relative radioactivity by end-window β counter above background. Maximum level about twice background.