A Filtering Technique for Identifying Local Maxima in Regional Geochemical Data Sets

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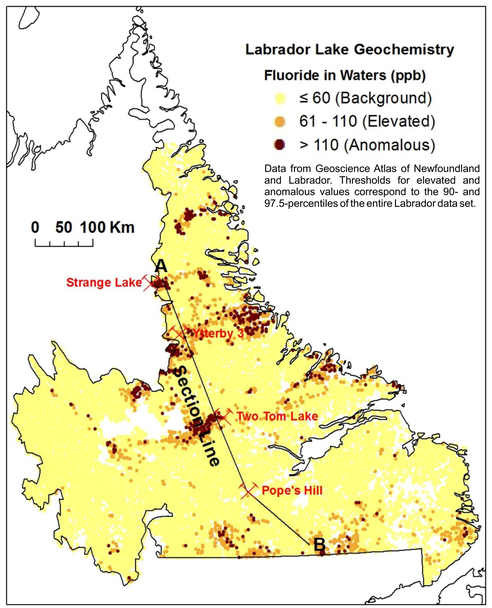
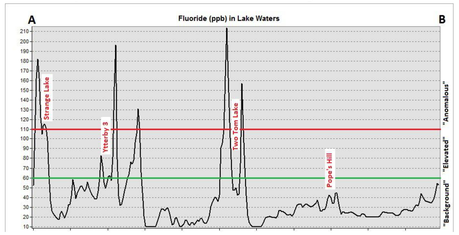
THE CHALLENGE

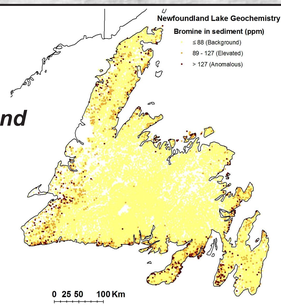
Strong regional (or "global") geochemical features tend to set the regional threshold too high for the detection of more subtle anomalies in areas of low background.



For example, the influence of such features in Labrador is such that the use of thresholds derived from data for all of Labrador results in almost all of the fluoride values from southern Labrador being classed as background, despite the presence of several local maxima, one of which is associated with the Pope's Hill REE discovery.

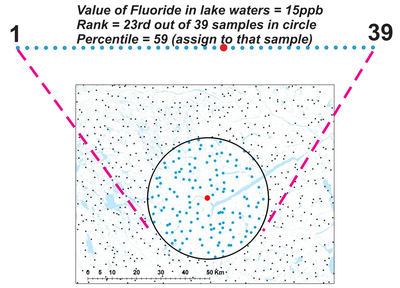


Similarly, regional Br patterns in Newfoundland lake sediments are dominated by high values in coastal lakes, and no anomalies are apparent in the interior of the island.

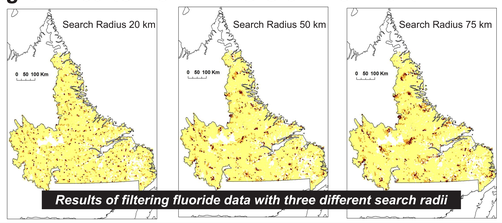


A SOLUTION

A filtering method is proposed whereby the content of each sample, for a particular element, is ranked with respect to all of its neighbours, within a specified radius. The rank is converted to a percentile which is then assigned back to the sample. The process is repeated for the next sample.

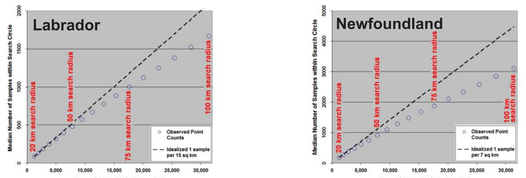


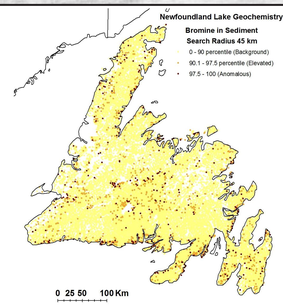
About 1,000 samples in each ranked subset seem to be necessary for patterns to emerge. Although the algorithm is relatively uncomplicated, the process is computer-intensive and has not yet been programmed to work in a GIS environment.



Results of filtering fluoride data with three different search radii

The median number of samples within each circle is not directly proportional to circle area because more of the larger circles are truncated by the boundary of the sampled area.

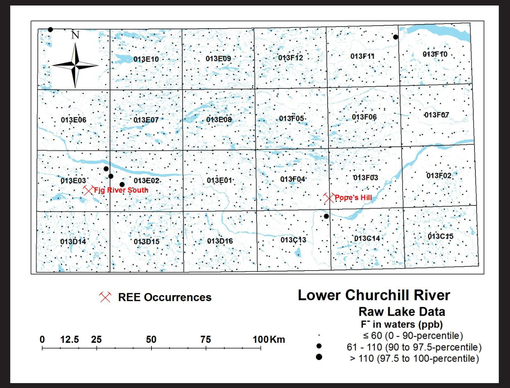




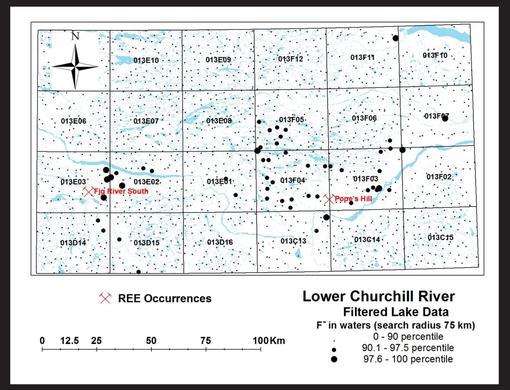
Filtering the Br data from Newfoundland results in the appearance of a number of local maxima in the interior of the island, although the strongest coastal anomalies are still discernible.

RESULTS

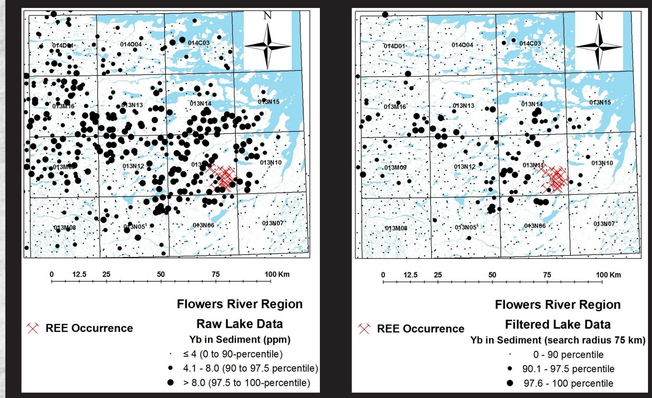
Raw values of fluoride in lake water indicate just one elevated value at the Pope's Hill REE discovery, and a weak anomaly at the Fig River South occurrence to the west.



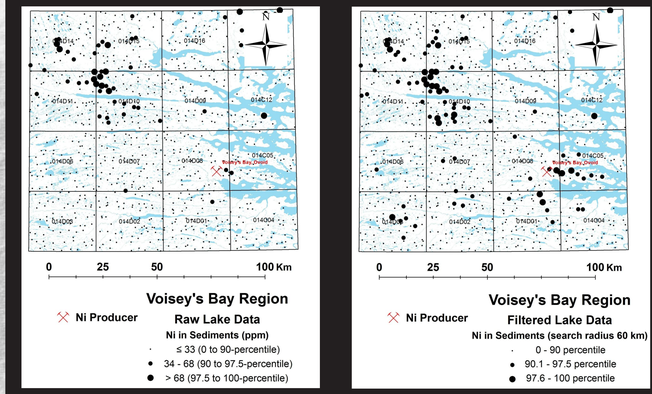
Filtered fluoride values indicate anomalies in the vicinity of both occurrences.



Where a large regional geochemical anomaly is present, for example Yb at Flowers River, filtering the data allows the identification of "hot-spots" within the larger anomaly. These do not necessarily coincide with known REE occurrences.



Filtered values of Ni in lake sediment define the Voisey's Bay deposits better than their unfiltered counterparts. Some stronger anomalies elsewhere are equally well-defined by unfiltered values and many of these have already been intensively prospected without conspicuous success.



Amongst the well-defined features that are revealed by filtering the Newfoundland lake sediment data in this way are anomalies of chalcophile elements on the Great Northern Peninsula, and south of Monkstown on the northeastern Burin Peninsula. Filtered values of As and other chalcophile elements indicate (inter alia) some untested features in the Cartwright region of southeastern Labrador that do not appear anomalous at all if "global" thresholds are applied, while the response in the Sims Basin of western Labrador is enhanced if the filter is applied to U values in lake sediments.

CONCLUSIONS

This approach has potential for identifying subtle anomalies in any large regional geochemical data set. It appears to provide the greatest additional benefit in data sets that include a few localized features of very strong response, which have already been identified in unfiltered data. For elements whose values are more evenly-distributed, such as Zn, filtering the data provides no significant advantage over the use of global thresholds.