Geochemical Trends in the Belgian Ardennes

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The paper summarizes the results of a regional geochemical survey in the Belgian Ardennes. Various geochemical trends are defined and tentatively interpreted; a possible relation between geochemical and metallogenic zoning is discussed.

Introduction

An extensive programme of geochemical investigations has been carried out in the Belgian Ardennes during the period 1970—1974 by the Mining Exploration Department of the International Institute for Aerial Survey and Earth Sciences (ITC). The programme included a regional stream sediment survey, detailed soil surveys and research projects relating to geochemical data analysis.

The present paper concerns the regional stream sediment survey; field and laboratory procedures will be outlined, followed by a geostatistical description of raw data properties and the presentation and interpretation of various geochemical trend maps.

Field and Laboratory Procedures

The region covered by the stream sediment survey is outlined in Fig. 1 and Fig. 2 and measures approximately 6800 km². The survey involved the collection of some 1700 routine samples at a sampling density of 1 sample per 4 km² pH values of streamwaters were measured at a limited number of stations.

The presence of ancient mine dumps, towns and villages and other potential sources of contamination in parts of the Ardennes impose severe restrictions on the selection of sampling sites. In order to avoid contamination in so far as possible, a procedure was chosen whereby routine samples were collected exclusively from streams of low order. Care was taken to maintain a reasonably constant sampling density. The procedure proved to be satisfactory for the production of the geochemical trend surfaces presented in this paper. The surfaces do not pretend to reveal local details, nor do they pretend to show local anomalies directly related to individual mineralizations. For this reason, and to avoid ambiguity, anomalous sample values have not been incorporated in the computations of any of the trend surfaces.

All routine samples were assayed on hot HCl extractable lead and zinc content in — 120 mesh fractions by atomic absorption. In the following discussion the trace metal values will be quoted in parts per million hot extractable metal.

Geostatistics

A general impression of the nature of the raw data may be obtained through examination of the frequency distributions. Overall frequency distributions of both the lead and zinc values of the 1700 routine samples approximate log-normal distributions. A geometric mean of 38 ppm and, employing the data lying between the 5th and 95th percentiles, an estimated range of 17 ppm to 160 ppm was computed for the lead values. A corresponding calculation for the zinc values produced a geometric mean of 110 ppm and a range of 35 ppm to 470 ppm.

The geographical distribution of lead and zinc values in the space of the surveyed region is inhomogeneous. With regard to zinc values, the region is made up of a minimum of 5
subregions with value frequencies differing significantly in means and variances. For lead, a division into 2 subregions suffices. Within each subregion the trace metal values are weakly homogeneous; autocorrelational properties in different subregions are comparable. For zinc values correlation distances for different directions were estimated to be 2 to 4 km. For lead values the estimates are 4 to 8 km.

To acquire further insight into the data structure a combination of geochemical data analysis techniques, including covariance studies and a particular cell average method as proposed by DE GEOFFROY et al. (1968) were employed. For a description of the techniques reference is made to DIJKSTRA and KUBIK (1975). The studies demonstrated that the overall variances of lead and zinc values represent a summation of variances relating to point deviations, areal undulations and undulations of sub-regional character. These undulations will henceforth be referred to as areal and regional trends. Point devia-