CHAPTER 5

CONSTRUCTION OF GEOCHEMICAL MAP BY TREND SURFACE ANALYSIS.

Trend surface analysis is one of the most common method used in univariate analysis. The method is applied to large quantities of geochemical data which requires computer processing (Peters, 1978). Trend surface analysis involves the fitting of mathematical surfaces to actual data. The surfaces are expressed by polynomial models such as shown in Fig. 5.1. The difference between the actual data and a computer trend surface is a residual. A residual map isolates local deviations from a regional trend and, ultimately, anomalies from background. The trend surface, therefore, contains the regional or systematic component of the variability of the data while the residuals include local or erratic geochemical values unrelated to the principal distribution (Nichol et al., 1969). In general, the fitting of trend surface does not depend on the location of the data points and hence, low-order polynomial surface have found wide application for establishing regional trends for geochemical data in which the sampling points are irregularly spaced (Levinson, 1974). Another use of trend surface analysis is to select variables other than the geographical coordinates and to account for regional and local effects of an observed distribution of a given trace elements (Levinson, 1974).

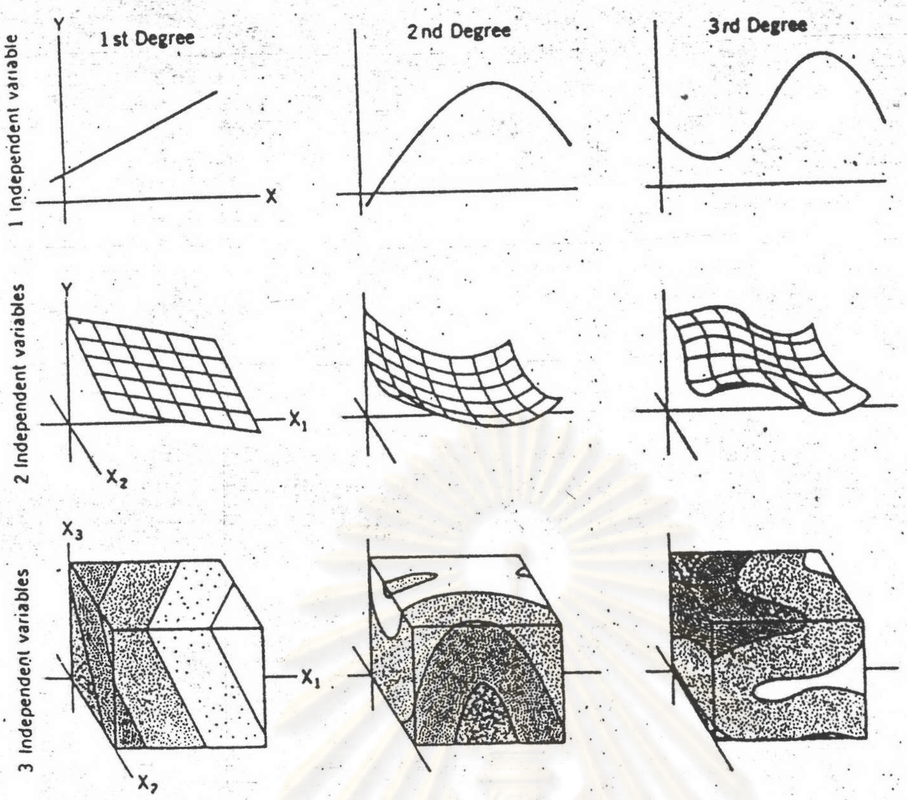

Fig. 5.1 Typical trends from curvilinear regression, trend surface analysis, and hypersurface analysis, involving one, two, and three independent variables. First, second, and third degree trends are shown (Afer Harbaugh, 1964).

5.1 Application of Trend Surface Analysis to construcl the geochemical map.

Trend surface analysis is applied as an aid to improve interpretation of geochemical data (Nichol et al., 1969). The method described by Davis (1973) was used to compute and establish the trend surfaces. The technique was conducted with microcomputer Hewlett Packard 85. The typical trend surface program consist of three basic parts : a routine to generate the matrix of sums of powers and cross-products, a simultaneous equation solver, and plot algorithm (Davis, 1973).

The matrix generator is developed in essentially the same manner as the one described for POLYD (Program 5.5 in Davis, 1973). Once the matrix equation is created, the unknown coefficients can be found by SLE (Program 4.9 in Davis, 1973). The least-squares equation can then be used to generate grid values to be printed by a print algorithm similar to PLOT (Program 6.2 in Davis, 1973). Almost all of the necessary parts of a trend surface program have already been combined in TREND (Program 6.3 in Davis, 1973). This program can compute polynomial trend surface of any specified degree. In this study, the regional trends can be separated into three major trends.

a A linear or first order trend surface is computed by the equation of

$$Y = b_0 + b_1X_1 + b_2X_2$$

b A quadratic or second order trend surface

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_1^2 + b_4X_2^2 + b_5X_1X_2$$

c A cubic or third order trend surface

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_1^2 + b_4X_2^2 + B_5X_1X_2 + b_6X_1^3 + b_7X_2^3 + b_8X_1^2X_2 + b_9X_1X_2^2$$

where Y = metal content at co-ordinate X_1, X_2

bi = coefficients

X_1 = the east-west co-ordinate component

X_2 = the north-south co-ordinate component

The local component or residual map is obtained by substracting grid value of observed data from trend surface values.

$$R(X_{1i}, X_{2i}) = O(X_{1i}, X_{2i}) - T(X_{1i} - X_{2i})$$

where $R(X_{1i}, X_{2i})$ = residual value at any X_{1i} and X_{2i}

$O(X_{1i}, X_{2i})$ = observed values at any X_{1i} and X_{2i}

$T(X_{1i}, X_{2i})$ = trend surface value at any X_{1i} and X_{2i}

5.2 Analysis of Trend Surface and Residual Maps.

Trend surface analysis was carried out for Cr, Co and Cu, First order or linear trend surface and second order or quadratic trend surface of these elements were computed to separate the regional trends from local variations.

The linear trend surface for Cr (Fig.6.3) and Ni (Fig.5.6) indicate that the levels are higher in the southwest than northeast, whilst the Co (Fig.5.13) and Cu (Fig.5.18) linear trend surfaces, the levels are higher in northwest than southeast. First order or linear trend surface of Cr and Ni both strike about N 30°W and dip in the NE direction. The linear trend surfaces of Co and Cu are in direction of N 70°E and dip SE. The directions of Cr and Ni linear trend surfaces are parallel to NW-SE trending of exposed ultramafic units. The second degree or quadratic trend for Cr (Fig.5.5) and Ni (Fig.5.10) are concentric. A fully formed ellipse with NW-SE axis span the study area, whereas a partial elliptical surface with similar elongation axes, are developed for Co (Fig.5.15) and Cu (Fig.5.20).

After separation of the regional trends, the remaining residual values attributed to local variations and random error were contoured to produce deviations or residual maps. The high positive values for Cr, Ni and Co indicate that the local anomalies of these elements are very strong. These high values are more clearly restricted to the area underlain by ultramafic rocks. The residuals for Cr (Fig.5.4 and Fig.5.6), Ni (Fig.5.9 and Fig.5.11) and Co (Fig.5.14 and Fig.5.16) distributions obtained from the trend surface analysis are remarkable similar pattern. The residual for Cu (Fig.5.19 and Fig.5.20) distribution shows small positive low values. These positive values are scattered throughout the sampled area and show no obvious structural or lithologic associations.

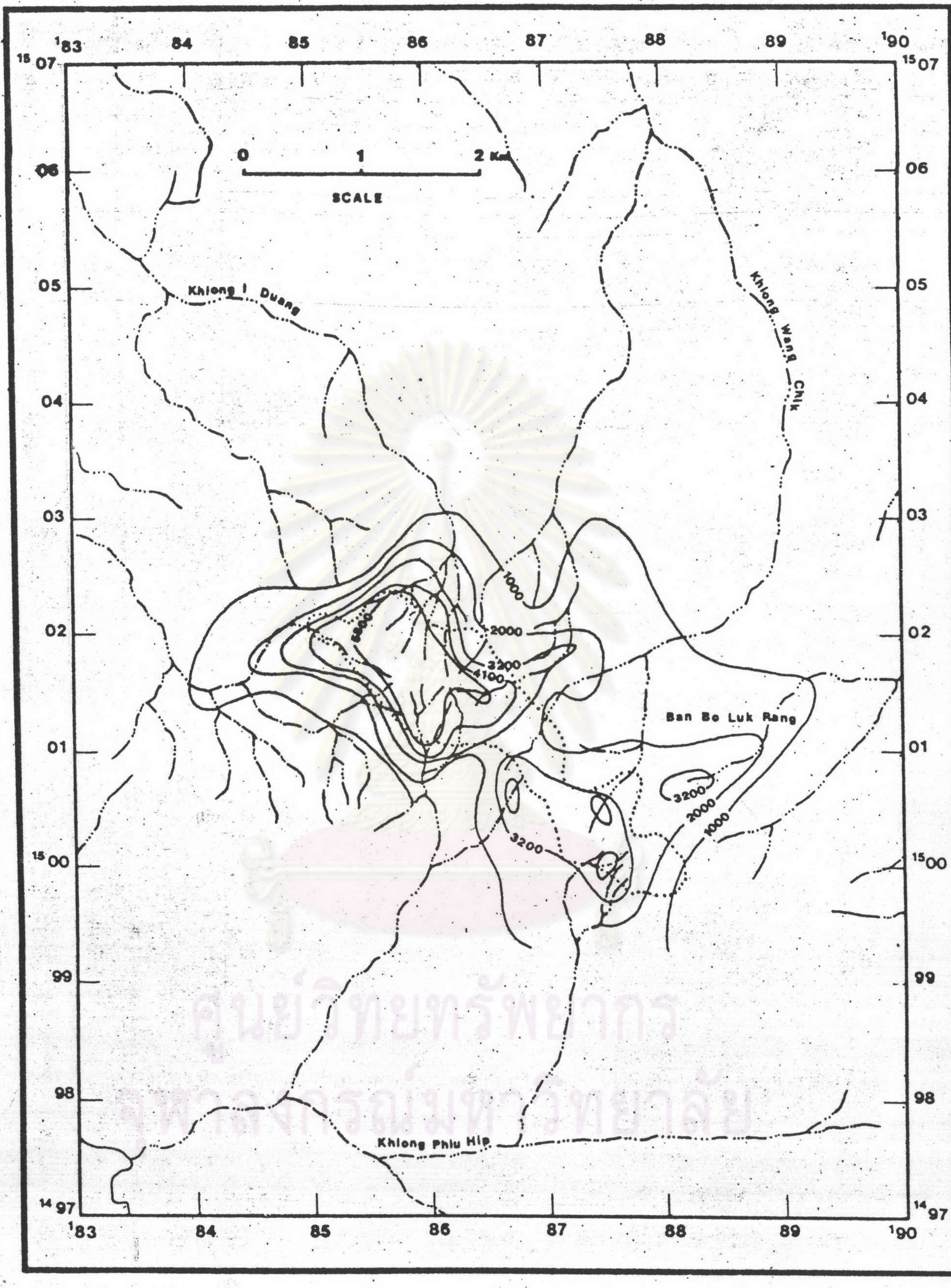

Fig. 5.2 Geochemical contour map for Cr distribution (ppm) in stream sediments based on raw data, Amphoe Wang Nam Yen, Changwat Prachin Buri.

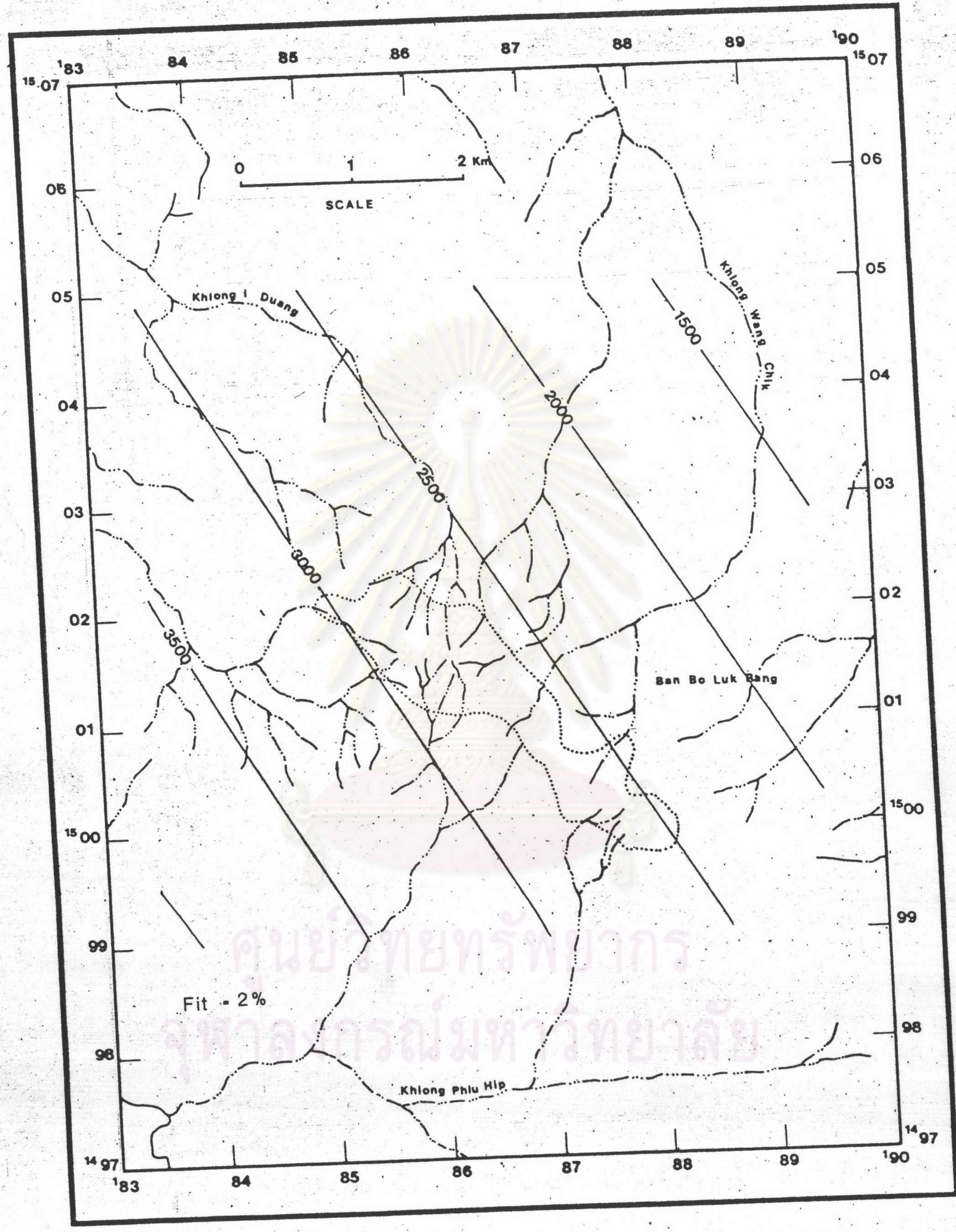

Fig. 5.3 Linear trend surface for Cr distribution (ppm) in stream sediments, Amphoe Wang Nam Yen Changwat Prachin Buri.

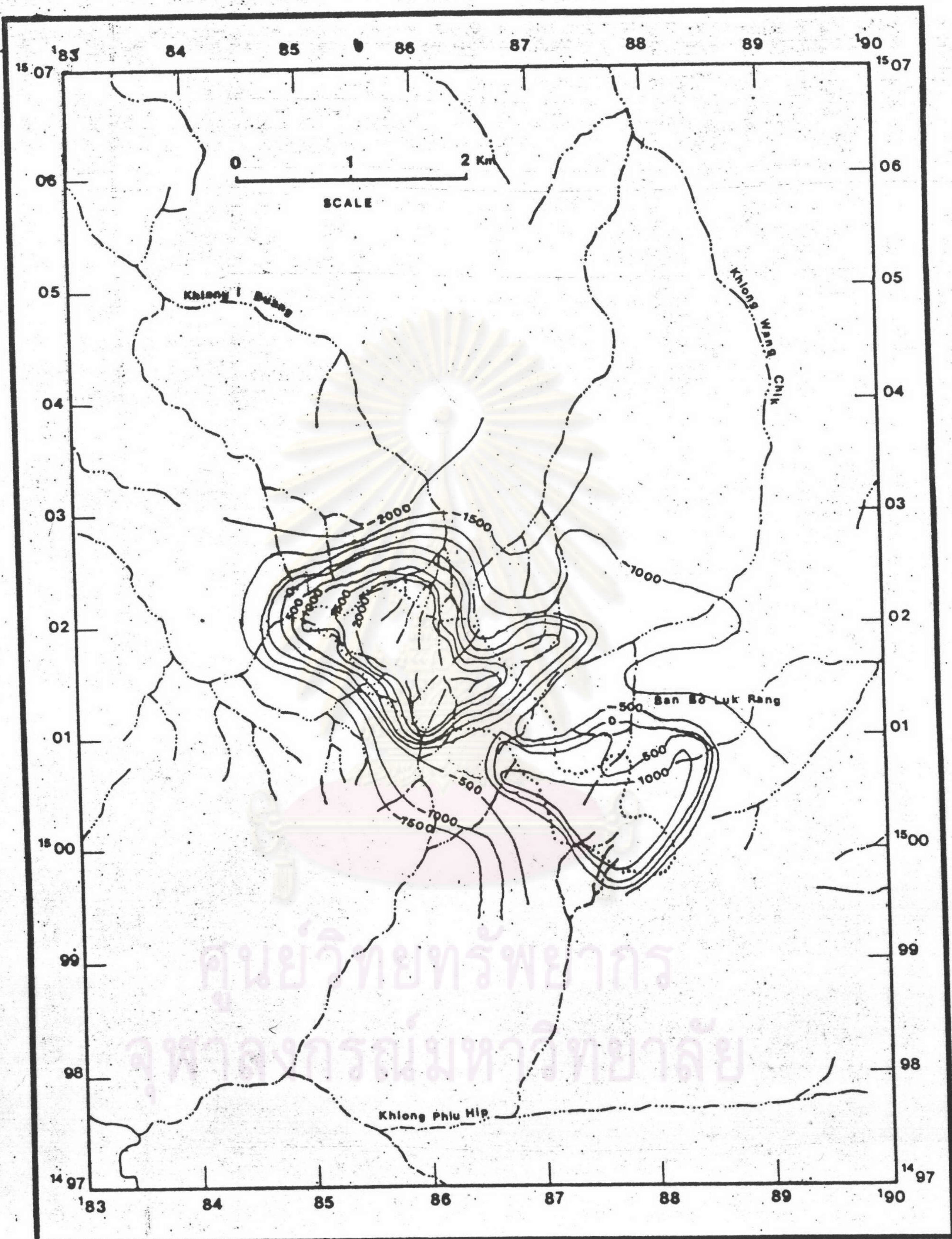

Fig. 5.4. Residual map for Cr distribution (ppm) obtained from linear trend surface, Amphoe Wang Nam Yen, Changwat Prachin Buri.

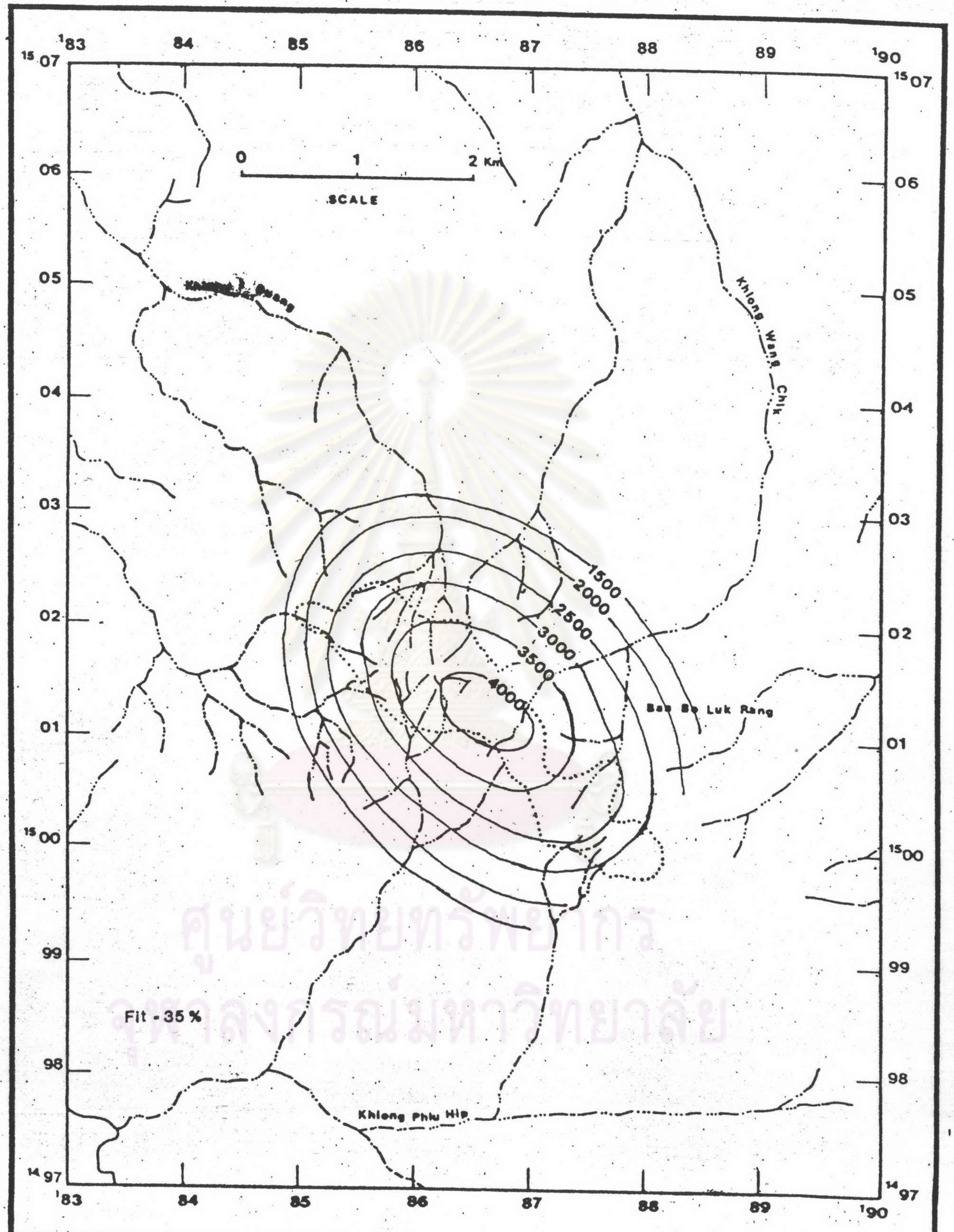

Fig. 5.5 Quadratic trend surface for Cr (ppm) in stream sediments, Amphoe Wang Nam Yen, Changwat Prachin Buri.

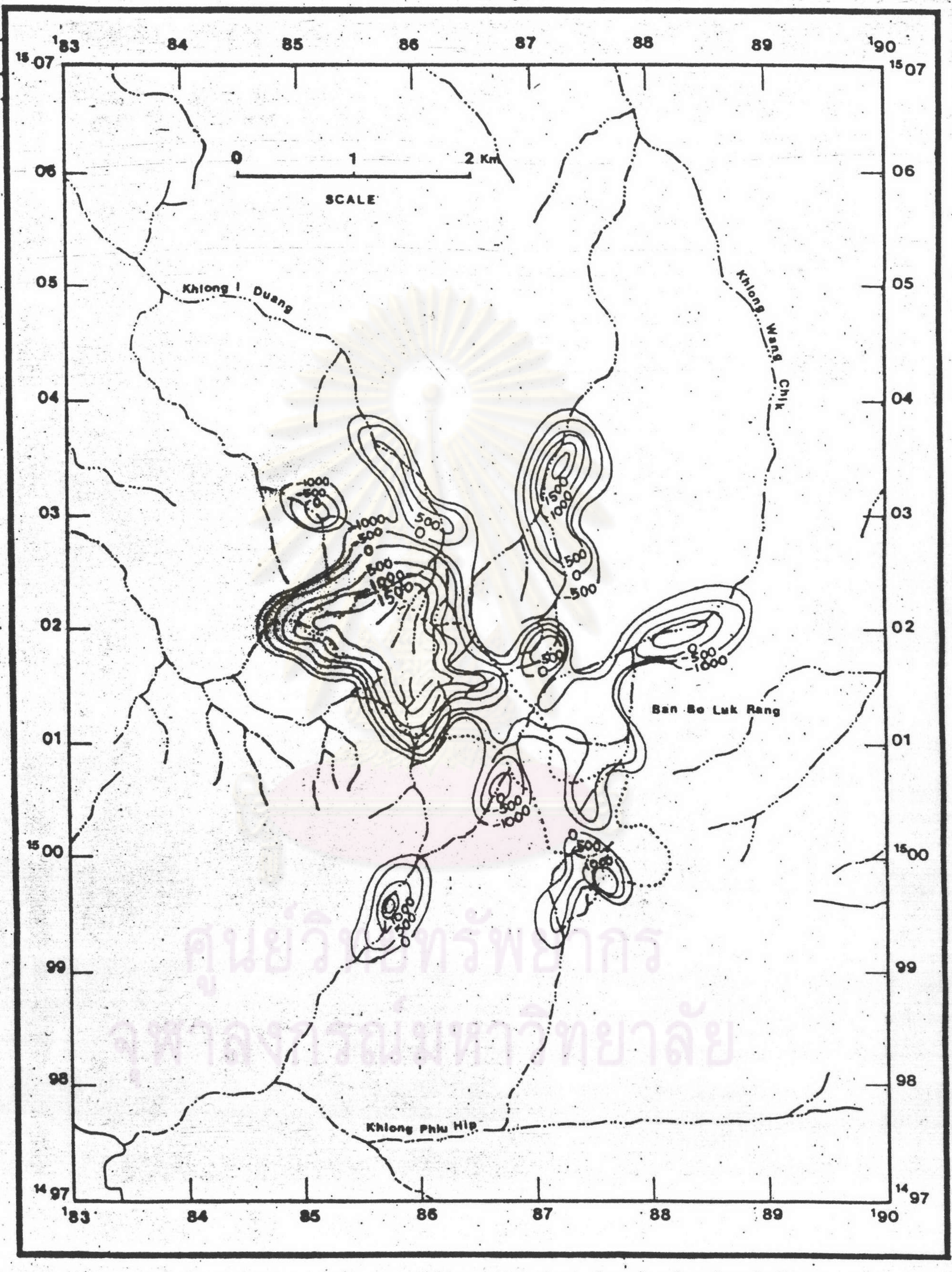

Fig. 5.6 Residual map for Cr distribution (ppm) obtained from quadratic trend surface, Amphoe Wang Nam Yen, Changwat Prachin Buri.

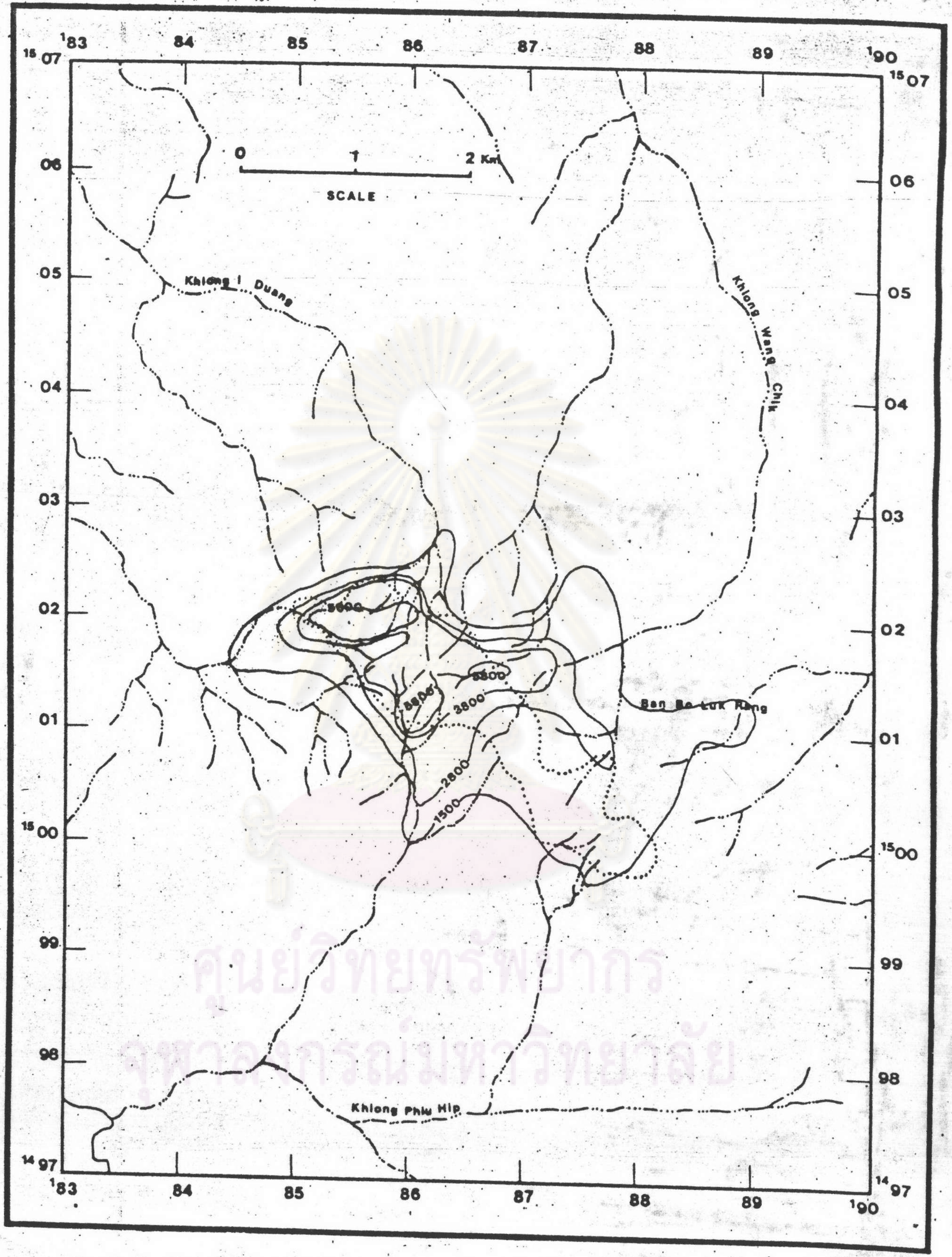

Fig. 5.7 Geochemical contour map for Ni distribution (ppm) in stream sediments based or raw data, Amphoe Wang Nam Yen, Changwat Prachin Buri.

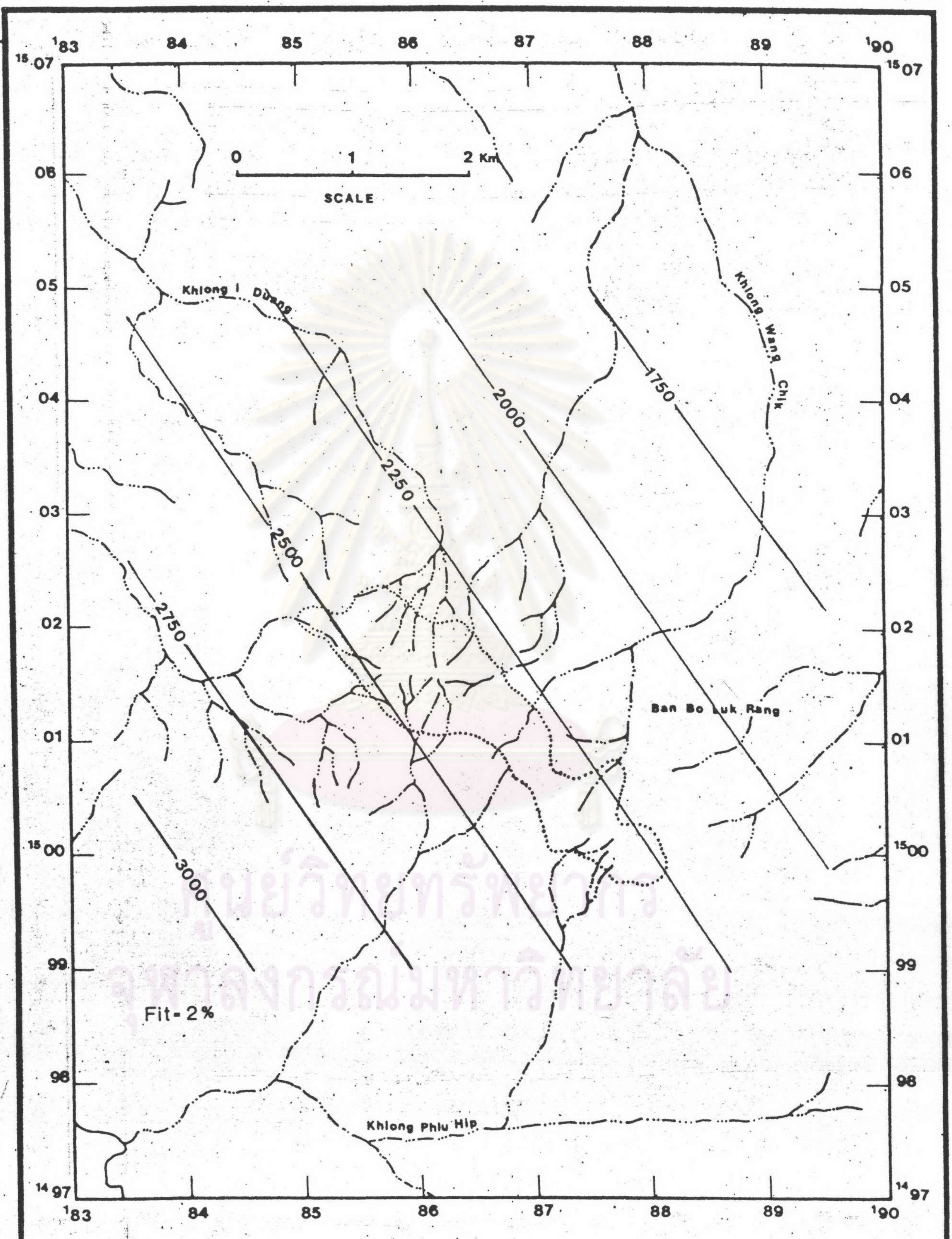

Fig. 5.8 Linear trend surface for Ni distribution (ppm) in stream sediments, Amphoe Wang Nam Yen, Changwat Prachin Buri.

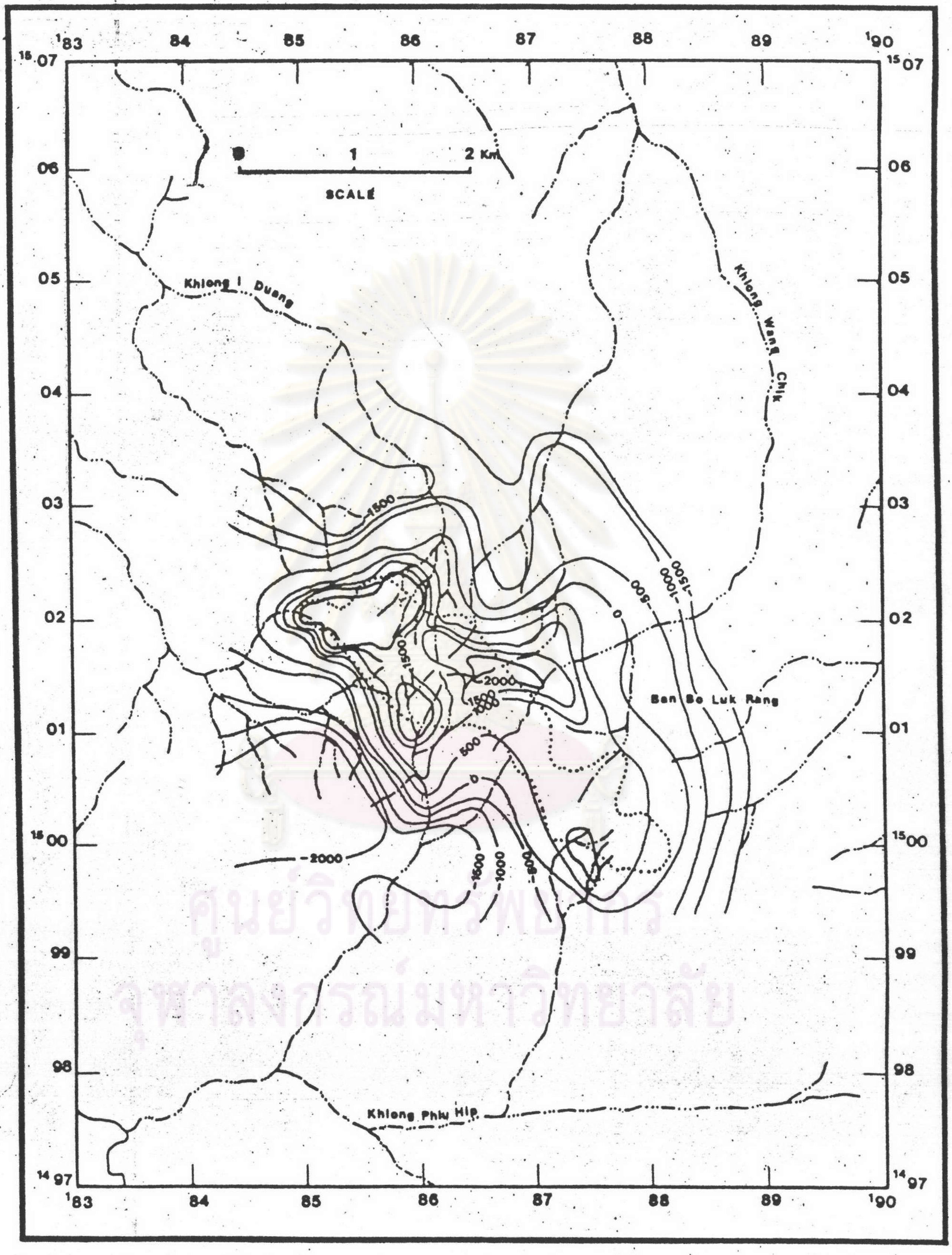

Fig. 5.9 Residual map for Ni distribution (ppm) obtained from linear trend surface, Amphoe Wang Nam Yen, Changwat Prachin Buri.

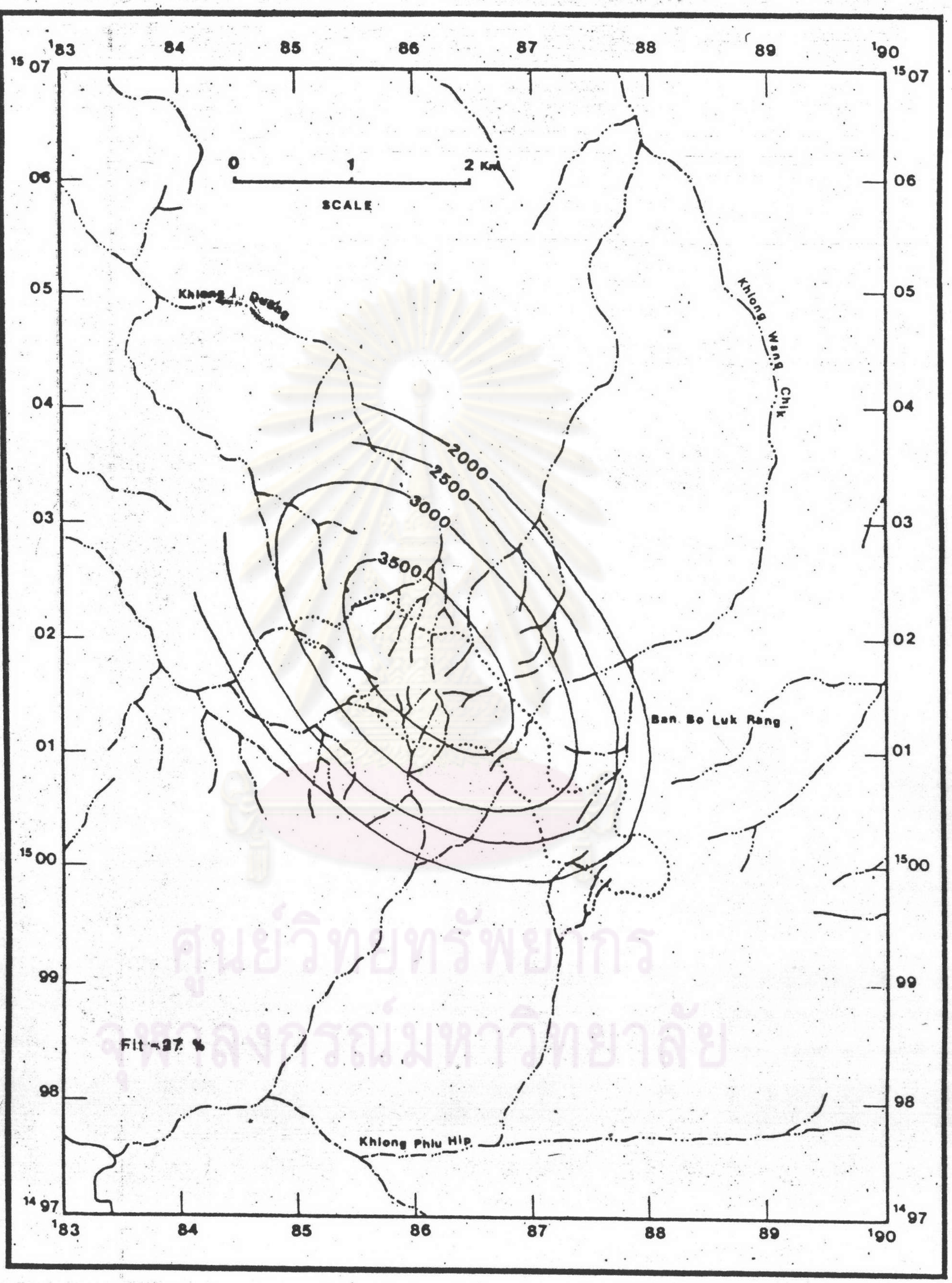

Fig. 5.10 Quadratic trend surface for Ni (ppm) in stream sediments, Amphoe Wang Nam Yen, Changwat Prachin Buri.

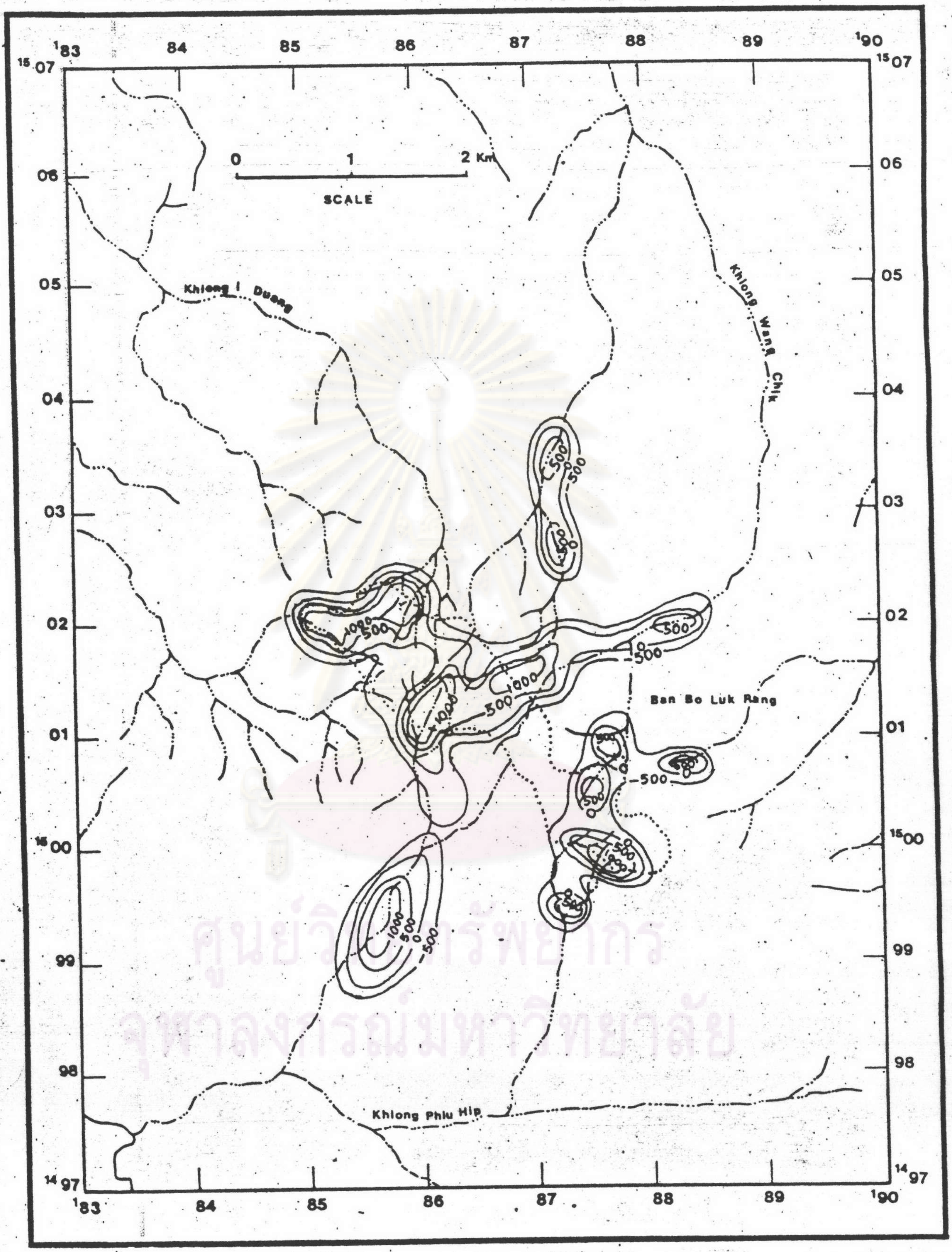

Fig. 5.11 Residual map for Ni distribution (ppm) obtained from quadratic trend surface, Amphoe, Wang Nam Yen, Changwat Prachin Buri.

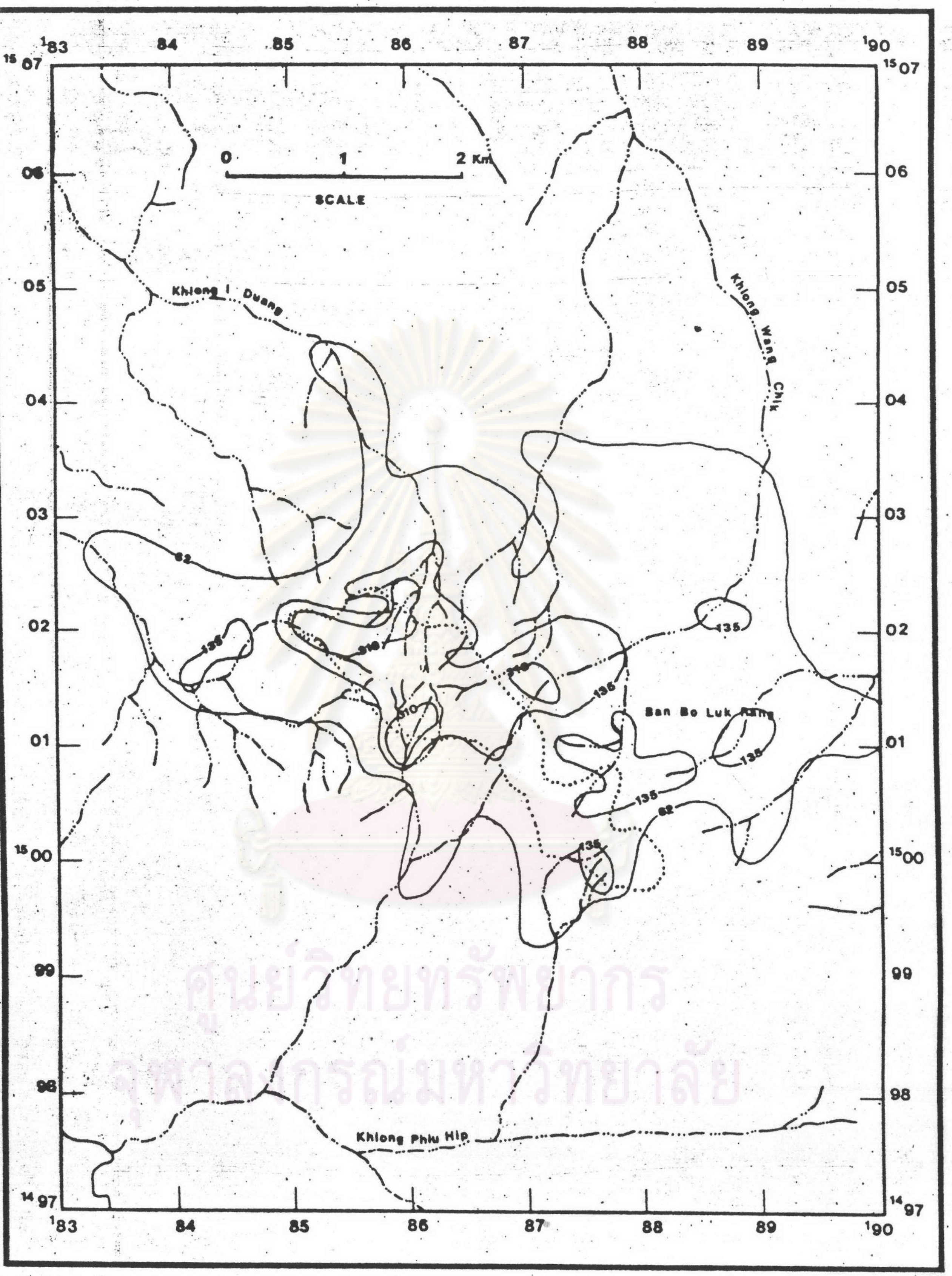

Fig. 5.12 Geochemical contour map for Co distribution (ppm) in stream sediment based on raw data, Amphoe Wang Nam Yen, Changwat Prachin Buri.

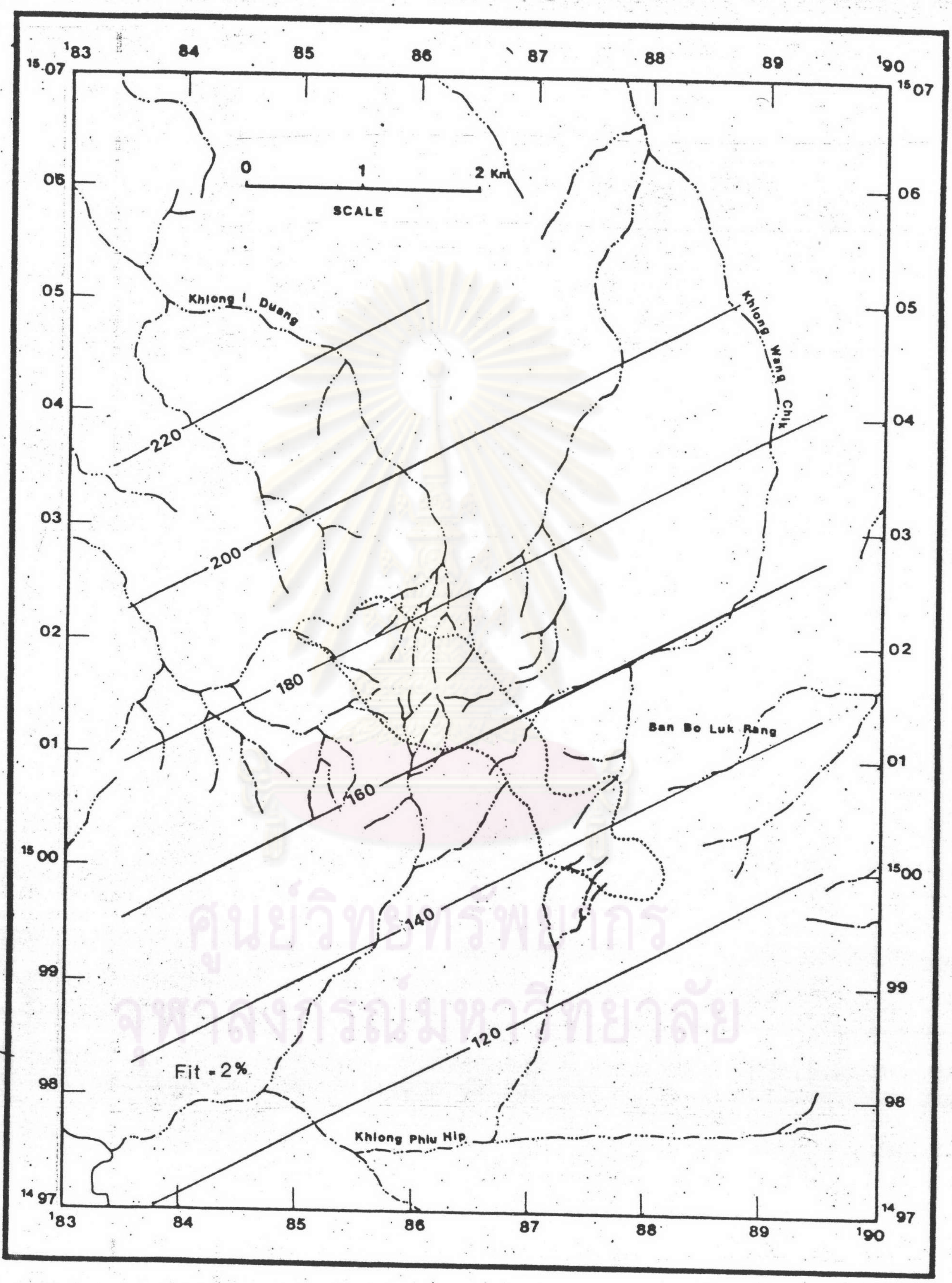

Fig. 5.13 Linear trend surface for Co distribution (ppm) in stream sediments, Amphoe Wang Nam Yen, Changwat Prachin Buri.

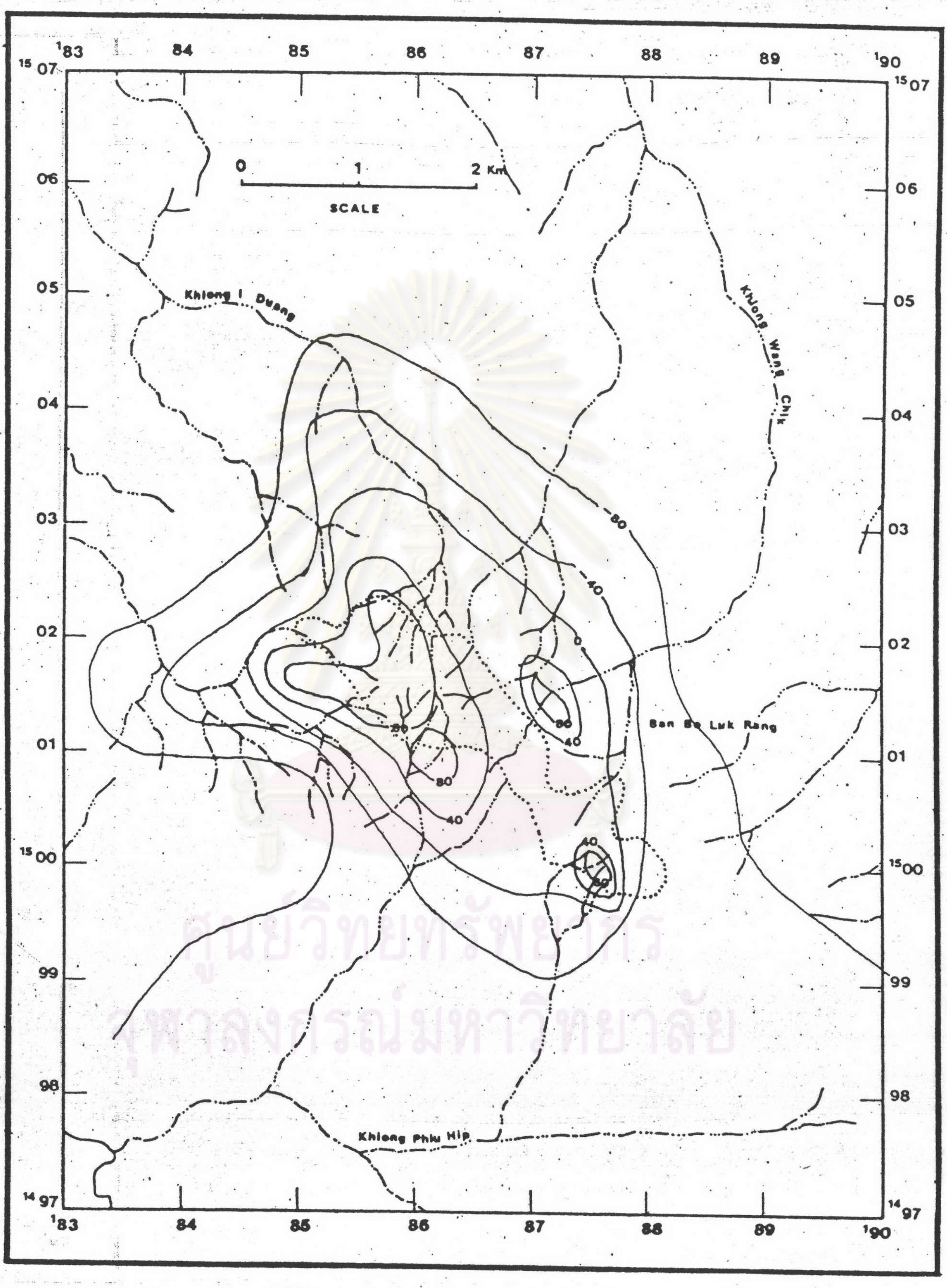

Fig. 5.14 Residual map for Co distribution (ppm) obtained from linear trend surface, Amphoe Wang Nam Yen, Changwat Prachin Buri.

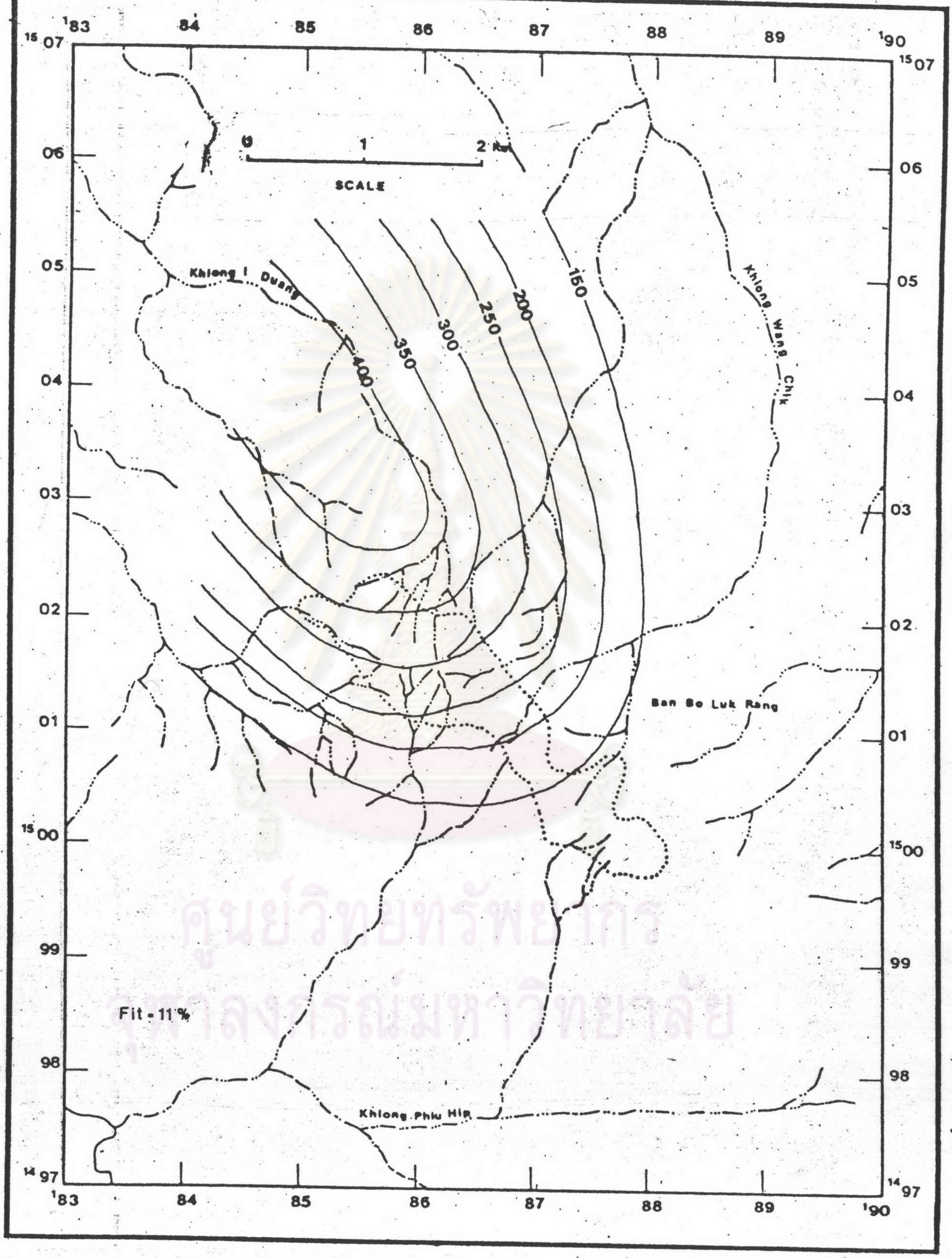

Fig. 5.15 Quadratic trend surface for Co (ppm) in stream sediments, Amphoe Wang Nam Yen, Changwat Prachin Buri.

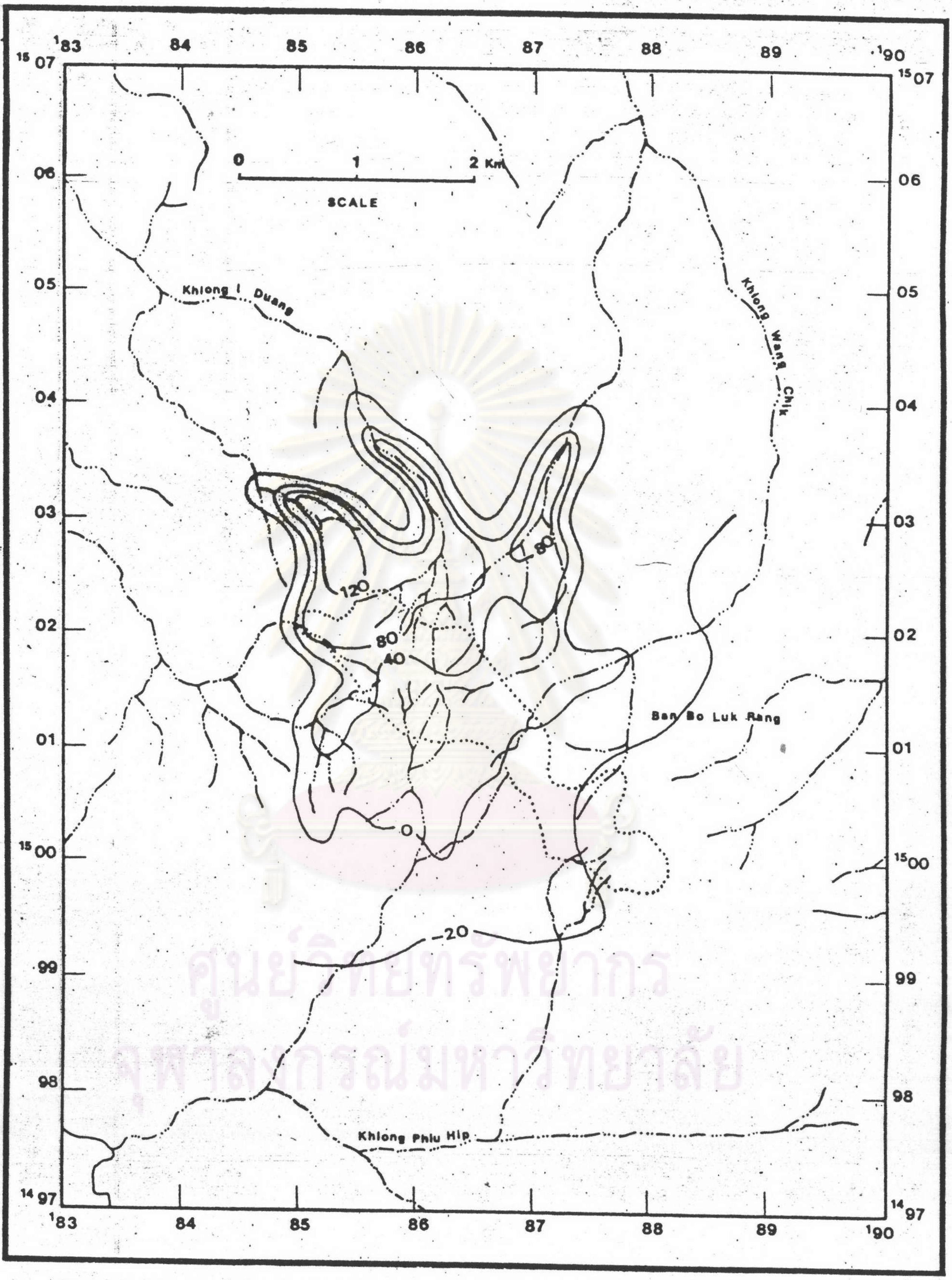

Fig. 5.16 Residual map for Co distribution (ppm) obtained from quadratic trend surface, Amphoe Wang Nam Yen, Changwat Prachin Buri.

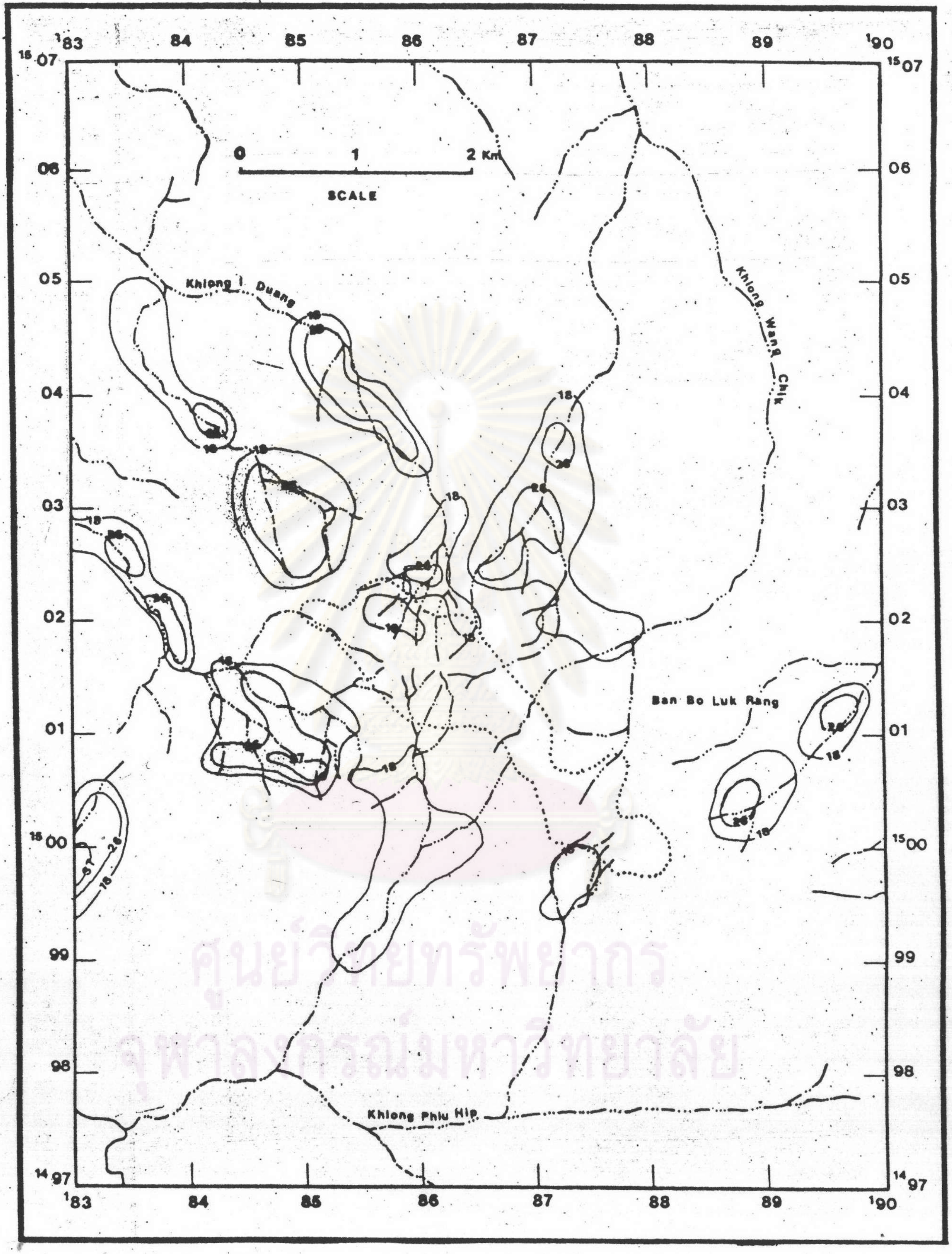

Fig. 5.17 Geochemical contour map for Cu distribution (ppm) in stream sediment based on raw data, Amphoe Wang Nam Yen, Changwat Prachin Buri.

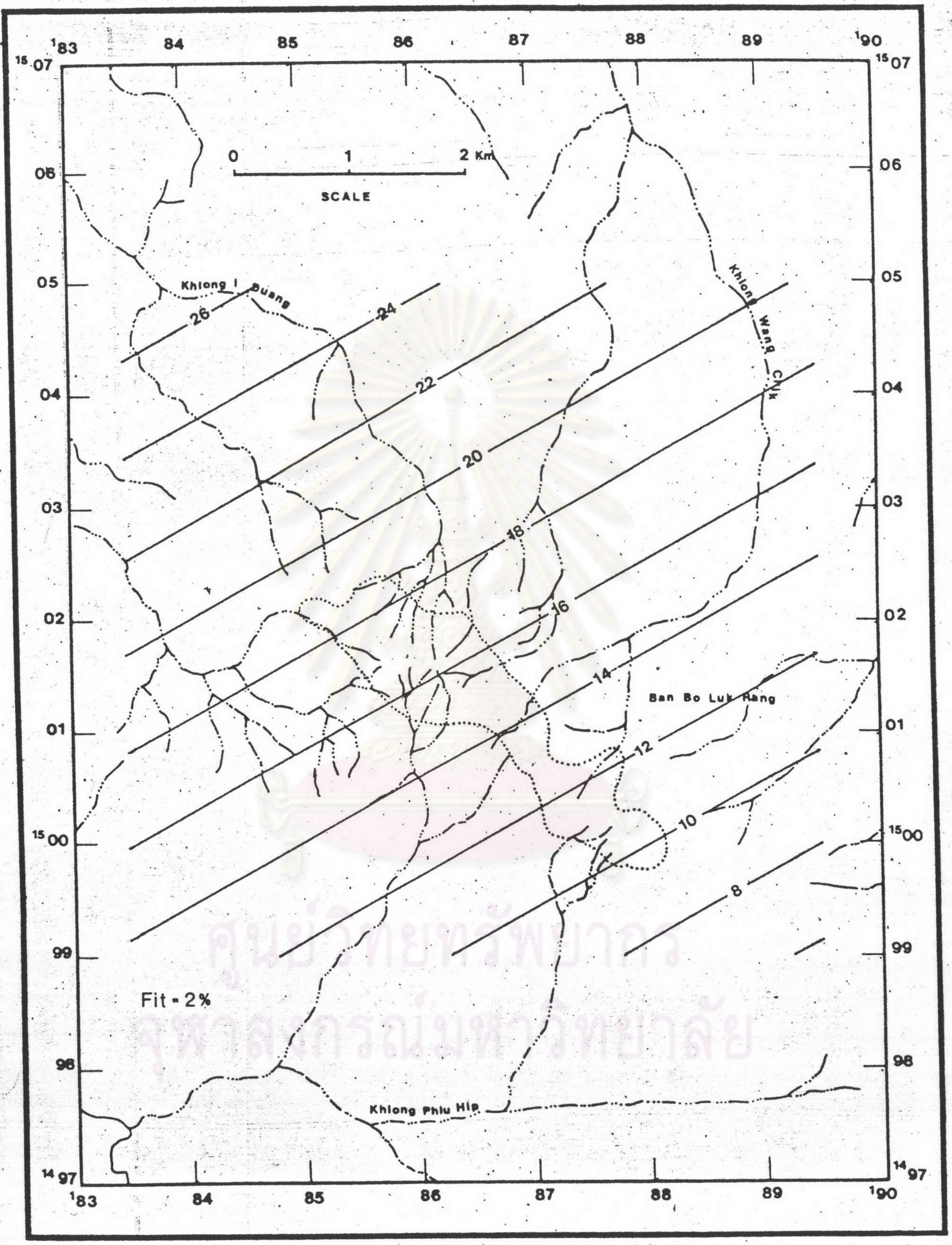

Fig. 5.18 Linear trend surface for Cu distribution (ppm) in stream sediments, Amphoe Wang Nam Yen, Changwat Prachin Buri.

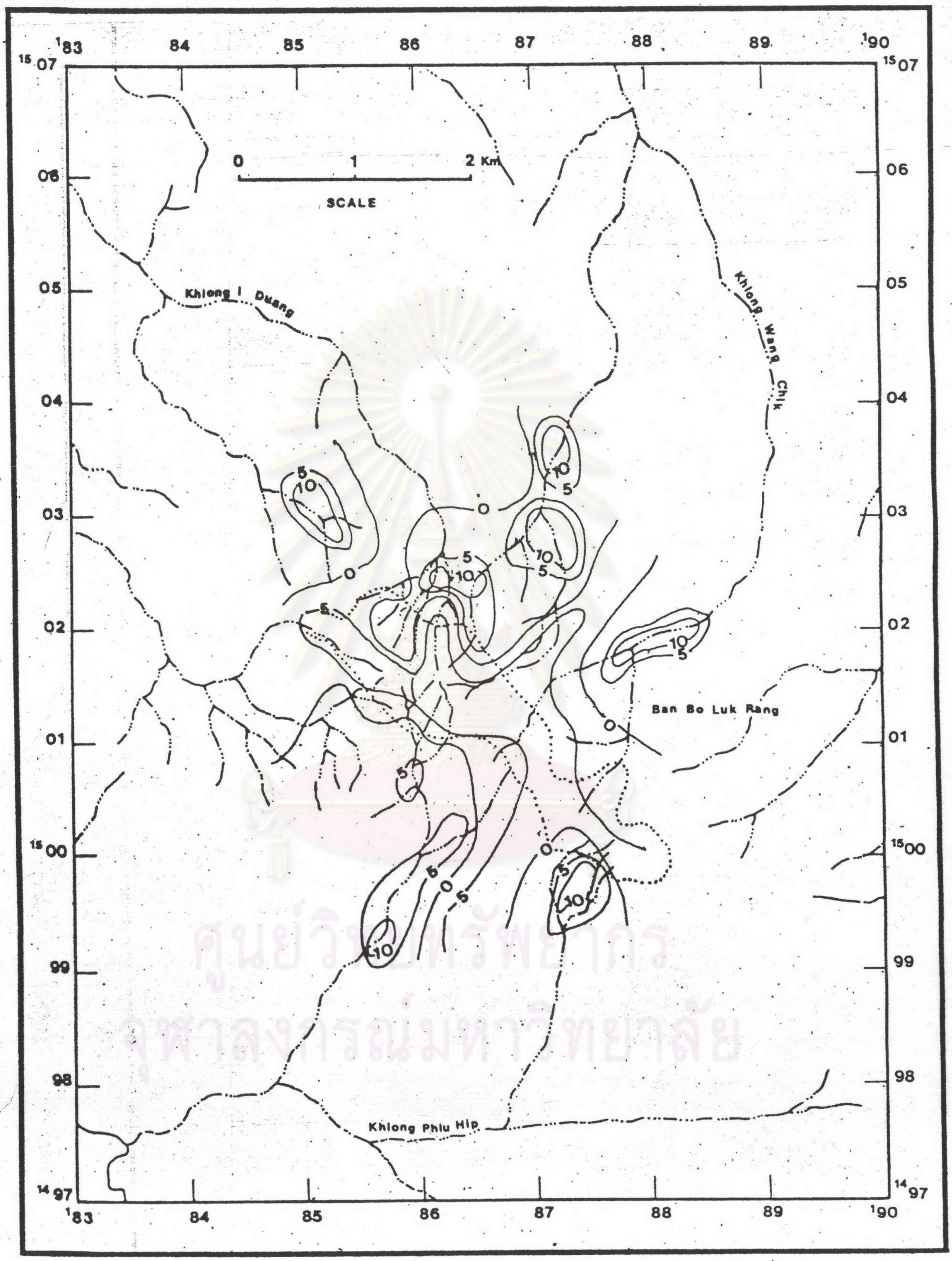

Fig. 5.19 Residual map for Cu distribution (ppm) obtained from linear trend surface, Amphoe Wang Nam Yen, Changwat Prachin Buri.

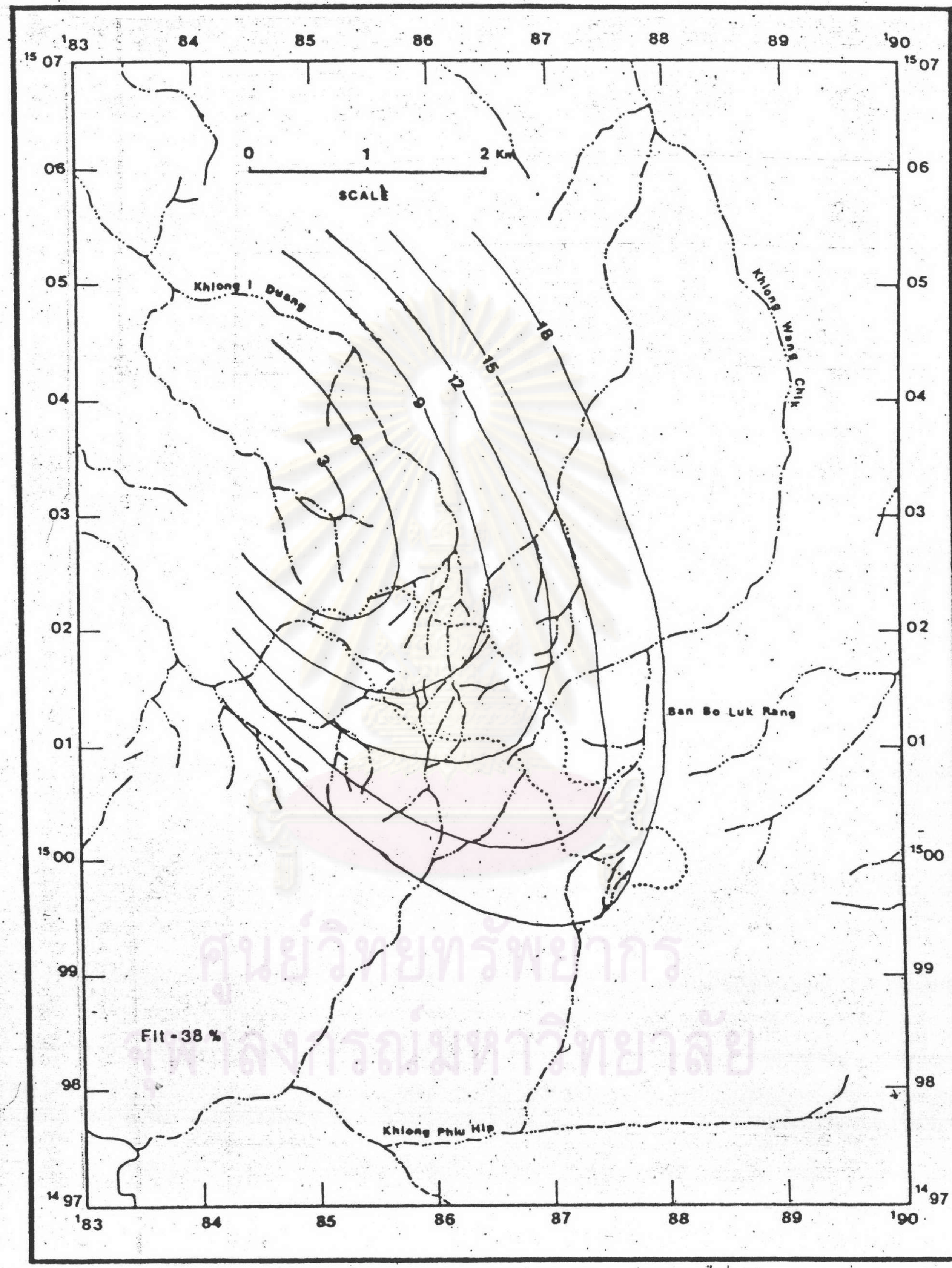

Fig. 5.20 Quadratic trend surface for Cu (ppm) in stream sediments, Amphoe Wang Nam Yen, Changwat Prachin Buri.

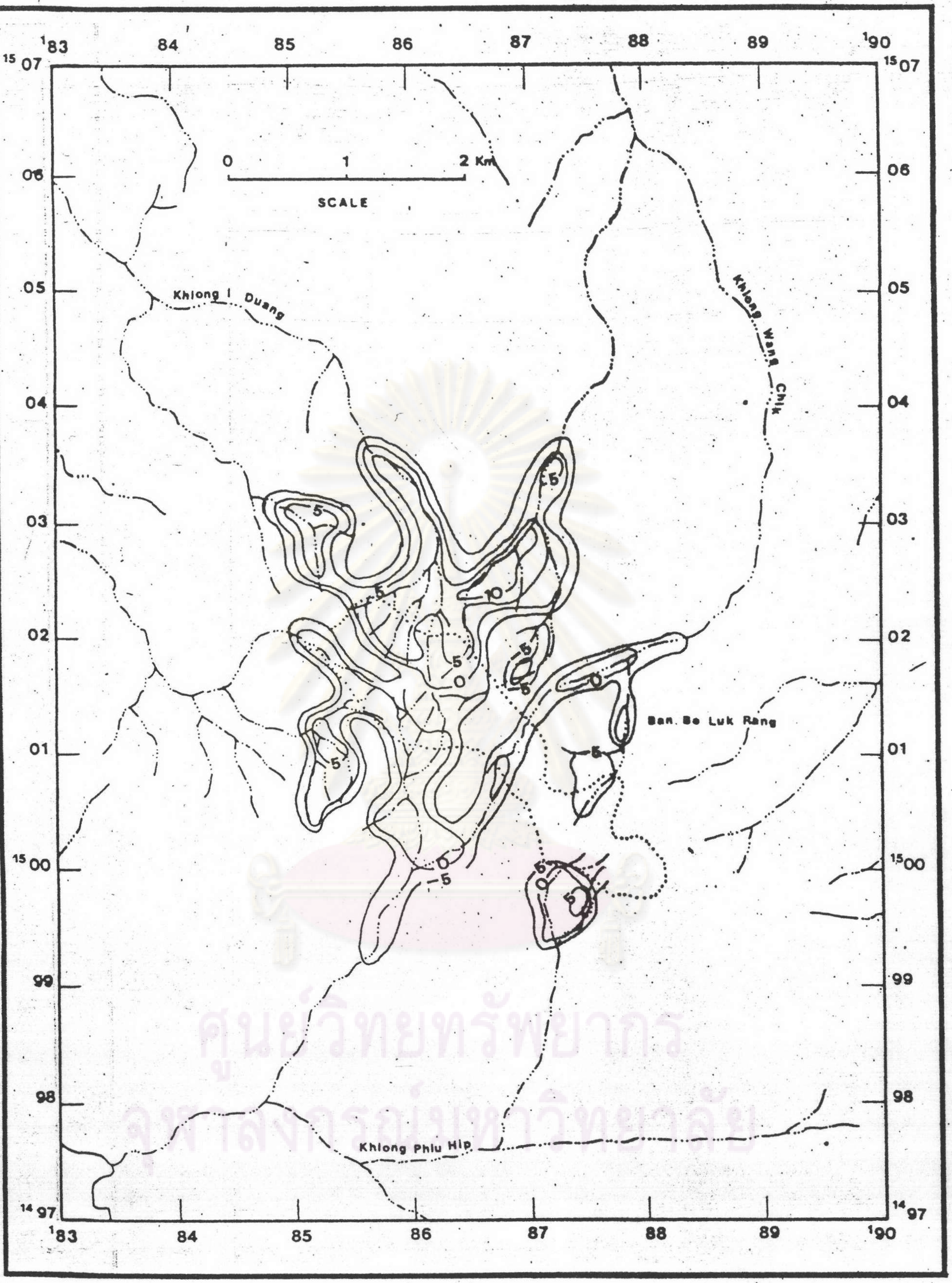

Fig. 5.21 Residual map for Cu distribution (ppm) obtained from quadratic trend surface, Amphoe Wang Nam Yen, Changwat Prachin Buri.