VARIOWIN: LOGICIEL POUR L'ANALYSE SPATIALE DE DONNEES EN 2D. ETUDE GEOLOGIQUE ET GEOSTATISTIQUE DU GITE DE PHOSPHATES DE TAIBA (SENEGAL)

PANNATIER Yvan, 1995

PhD adviser: Prof. Michel MAIGNAN, Institut de Minéralogie et Pétrographie

This Ph.D. thesis is divided into two parts: the development and usage of software for spatial data analysis are described in the first part and a geological and geostatistical case study conducted on the Taïba phosphate deposit (Senegal) can be found in the second part.

VARIOWIN 2.1 is a Windows based software including three separate modules for analyzing and modeling graphically the spatial continuity of 2D data: PREVAR2D builds a pair comparison file which can hold several hundreds thousands of pairs; VARIO2DP is used for characterizing and describing spatial continuity; and MODEL allows for an interactive modeling of experimental variograms produced with VARIO2DP. A methodological help on line which reproduces the user's guide found in the appendix of the first part of this work has also been included in the software.

VARIOWIN was developed using C++ and object oriented conception. A detailed description of the software design using class and object diagrams is given in the first part of this work. An explanation on how object oriented conception can be used to design a performing, evolving and robust scientific software is also provided.

The geological study conducted on the Taïba phosphate deposit presents a genetic model with which all field observations made so far on this deposit can be interpreted within a coherent evolutionary framework. This model proposes a two-phase evolution for the Taïba deposit :

- a sedimentary phase taking place between Middle Eocene and Middle Miocene during which original limestones, phosphatic marls interbedded with phosphorites and argilaceous sands are deposited;
- a weathering phase which started in the Middle Miocene and ended 18'000 years ago and during which subsurface karstification of limestones and marls, weathering of phosphorites and partial laterization of argilaceous sands occured.

The geostatistical study makes use of the genetic model to define the upper and lower limits of the calcium phosphate layer. A chemical criterion which allows the incorporation in the layer of the total calcium phosphate found on the deposit is proposed. A stochastic model reproducing the decametric fluctuations of both the lower limit and the thickness of the calcium phosphate layer is built using Sequential Gaussian Cosimulation.

A program written in FORTRAN 77, SGCOSIM, was developed. It implements the Sequential Gaussian Cosimulation algorithm in such way that it could be used in other fields where a stochastic model of spatially correlated variables is needed.