

From Graphical Display to Dynamic Model: Mathematical Geology in the Earth Sciences in the 19th and 20th Centuries

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Graphical displays were used in early geophysics, crystallography, mineralogy, petrology, and structural geology by 1800, but 19th Century geology obstinately remained largely descriptive. Lyell's (1828) quantitative classification of the Tertiary was a notable exception. Nevertheless, by 1920 the quantitative approach had become established. Krumbein, who first introduced the computer into geology (1958), encouraged use of probabilistic sampling and introduced process-response models. Early work focused on databases, statistical data analysis, and display. By the 1970s, stochastic simulation, deterministic modelling, and Matheronian 'geostatistics' were of growing importance. The introduction of the personal computer and the graphical user interface in the 1980s brought well-proven quantitative methods out of the research environment onto the workbench and into the field. Since the mid-1980s, the analysis, display, and modelling of behaviour in 3-dimensions, underpinned by spatial statistics, computational fluid-flow, visualization technology, *etc.*, has proved of economic benefit to mining, petroleum- and hydro-geology. Other, computationally intensive, methods likely to be of importance in the earth sciences are the application of 'robust' statistical methods; increasing use of Bayesian methods in uncertainty (risk) estimation (as a result of a renewed interest in statistical intervals and forecasting); and computational mineralogy.