

Models and scenarios in earth and planetary science

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Earth and planetary science as well as astronomy and biology have an aspect which should be called say "history-reconstructing science" contrary to reductionist science such as elementary particle physics. History-reconstructing sciences try to give a causal explanation on existence and phenomena of the past and the present based on evidence and reconstruct the history of Universe, Earth, and Life from the Big Bang to the present. It is not until the latter half of the 20th century that the contemporary history-reconstructing sciences began to develop based on the fruits of modern reductionist sciences.

On history-reconstructing sciences "scenarios" have an important role. A scenario is a description of genesis and evolution of objects, fields, and events under consideration, whereas a model is a logical explanation of a particular elementary step of the genesis and evolution. A scenario is a patchwork of elementary-step models without solid logics and sound evidence of the needlework. The scenario is something like a world-covering web with model nodes snapped to the real world. The models have tools such as theories, observations (important for history-reconstructing science), and experiments.

Though scenarios themselves have an old origin in myths or Genesis before establishment of reductionist science, they are "weak scenarios" at that time with few supporting models based on scientific evidence. In earth science it is not until the 1960s that "strong scenarios", such as plate tectonics, with abundant supporting scientific models emerged.

We will discuss the structure of history-reconstructing science, especially the relation between a scenario and the component models, using an example taken from research development in the field of planetary formation including discovery of extrasolar planets.

Keywords: philosophy of science, history of science, model, scenario, planetary system formation, naturalism