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Historical reconstruction in science

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Earth science includes reconstruction of the Earth's past as its central project. It tells us about courses of things such as the formation of the Earth, climate change, the rise and fall of dinosaurs and so on. Seemingly, these narratives merely describe what happened in the past.

On the other hand, it may be considered reasonable to say that historical reconstructions in Earth science are something more than mere descriptions, that is, they are at the same time scientific explanations. If so, the following problems would arise.

- (1)How do historical reconstructions give us scientific explanations and what kind of explanations are they?
- (2)What is the source of their explanatory power?

Philosophy of science has proposed several models of scientific explanation. But they would be no good with the solution of the above problems. For instance, Carl Hempel's deductive-nomological model of explanation does not apply to historical reconstruction, because Earth science does not assume any single general covering law which governs all the possible histories of the Earth. Philip Kitcher's unificationist view will not suffice, because the view, by itself, does not tell us anything about the totality which historical reconstruction of the Earth's past should be unified into. Clearly we need some special model of scientific explanation to do justice to historical reconstructions qua explanation.

We will propose a new view of scientific explanation which, we hope, can address the two problems above. The view is based on two preceding works. The one is Kim Sterelny's distinction between an actual-sequence explanation and a robust-process explanation (see also M. G. Kleinhan et al: 2010). Take an example of explaining why the WWI happened, the former corresponds to saying that the assassination of the Austrian archduke caused the WWI, while the latter refers to the socio-political situation of Europe at the time. Robust-process explanations are deeper than actual-sequence explanations, because they include many possible courses of events which could have led to a worldwide warfare without the assassination in Serbia. The second work we heavily depend on is Sei-ichiro Watanabe's Scenario-Model view of paradigms in earth science. Watanabe took Hayashi's model in planet formation theory as an example and claimed that it should be regarded as a complex made of several models arranged along a rather loose description of the course of major events (i.e. scenario).

Our view puts these predecessors together. The gist of it is as follows:

A historical reconstruction in earth science renders a robust-process explanation in Sterelny's sense, because the scenario it includes puts the actual causal sequence of events in a space of possible causal chains.

Keywords: philosophy of science, scientific explanation, history, scenario, model