

The role of tectonics and climate linkage in the Earth System history - An example of the mountain uplift and strengthen

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The linkage between tectonics and climate could be an important process to control earth's surface environment on million years or longer time-scale. Collision of continents and consequent uplift of mountains is an important part of Wilson Cycle during the assembly of super continent and should enhance physical weathering. Enhancement of physical weathering, in turn, increases specific surface area of rocks and minerals in the earth's surface environment and enhance chemical weathering. Enhancement of chemical weathering consumes CO₂ in the atmosphere and also resulted in the increase in nutrients supply to the ocean, the latter further enhance the uptake of CO₂ by the increase in biological productivity in the ocean. Furthermore, formation of supercontinent and/or large plateau will cause strong monsoonal climate that further accelerate chemical weathering through enhanced precipitation. A series of these processes, triggered by continental collision and uplift of mountains, should act as a strong positive feedback to promote global cooling. However, validity of this idea has not been vigorously tested by geological evidence due to the technical difficulty.

Uplift of Himalaya and Tibetan Plateau (HTP) has been believed to have caused enhancement of monsoonal circulation in Asia and pCO₂ decrease during Cenozoic. Because it is the most recent example of the continental collision and regarded as a textbook example of tectonics-climate linkage, it is worth to evaluate the possibility of the positive feedback explained above. Exploring when and how Asian monsoon evolved and whether such evolutionary process was closely related with the uplift of HTP is the first step to test the existence of the positive feedback loop to enhance global cooling. IODP is planning series of expeditions to explore this possibility and Exp. 346 to the Japan Sea and northern East China Sea is the first one to proceed this direction.

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