

TRIGGERS OF CLIMATE CHANGE

The forces driving the glacial/interglacial cycles that have characterized the earth's climate over the past three million years, are not fully understood, but mounting evidence indicates variations in the earth's orbital parameters most likely trigger them. The superimposed cycles of precession, obliquity and orbital inclination closely match the climatic record derived from deep-sea cores, implying a strong causal relationship. The 100,000-year cycle of orbital inclination and eccentricity appears to have the strongest climatic influence, as major glaciations occur every 100,000 years or so. One model is that as the earth's orbital plane tilts through a disk of dust surrounding the sun every 100,000 years the amount of solar energy reaching the Earth is diminished, triggering a glaciation. Another is that as the eccentricity of the earth's orbit changes on a 100,000-year cycle, the distance to the sun changes, resulting in slight changes in the amount of the sun's energy reaching the earth. There is a potentially serious problem with the entire hypothesis linking climate change and orbital parameters. The variations in the orbital parameters have probably been fixed for at least a billion years, but the current period of glacial/interglacial climatic cycles goes back only about three millions years. The resolution of this potential conflict might lie in plate tectonics. The configuration of the continental plates greatly influences water circulation in the oceans, which distributes the sun's energy around the globe. Certain continental configurations and circulation patterns might create unstable conditions in which even the weak influence of orbital variations can produce drastic climatic changes, while other configurations might produce stable conditions that would inhibit them. For example, the present period of glacial/interglacial cycles might have been initiated by the tectonic closing of the isthmus of Panama about three million years ago. Prior to the closing, global circulation was strongly east-west, inhibiting warm ocean currents from moving toward the poles. Presently, there are strong north-south currents, such as the Gulf Stream in the Atlantic Ocean, which distribute the sun's energy more evenly over the earth's surface.

PRECESSION
23,000-YEAR
AND
19,000-YEAR
CYCLES

ISTHMUS OF
PANAMA *

**PLATE
TECTONICS
CONTROL OF
OCEAN
CIRCULATION**



OBLIQUITY
41,000-YEAR
CYCLE

**ORBITAL
INCLINATION
& ECCENTRICITY**
100,000-YEAR
CYCLE

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