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To whom it may concern,

This is a certificate that this overseas research is supported from the grant of the Japanese Ministry of Education, Science and Culture, No. 18540417.

Title: Research of billion-year-scale time variation in the geomagnetic field intensity using granites in the Minnesota River Valley.

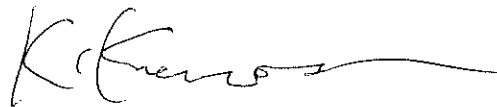
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Yours sincerely,

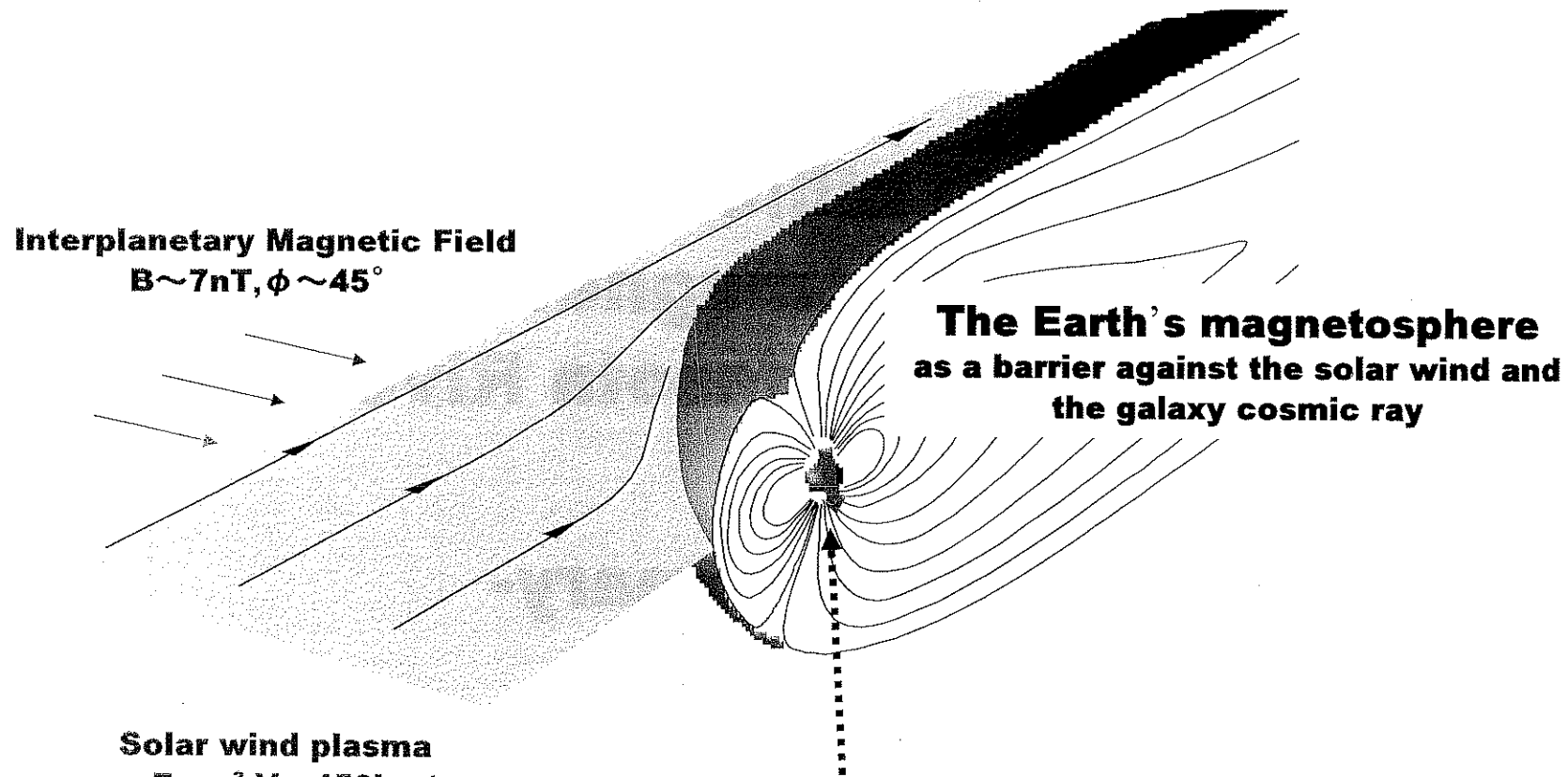


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**Research of the billion-year-scale time
variation in the geomagnetic field using
granites in the Minnesota River Valley**

-Short summary-

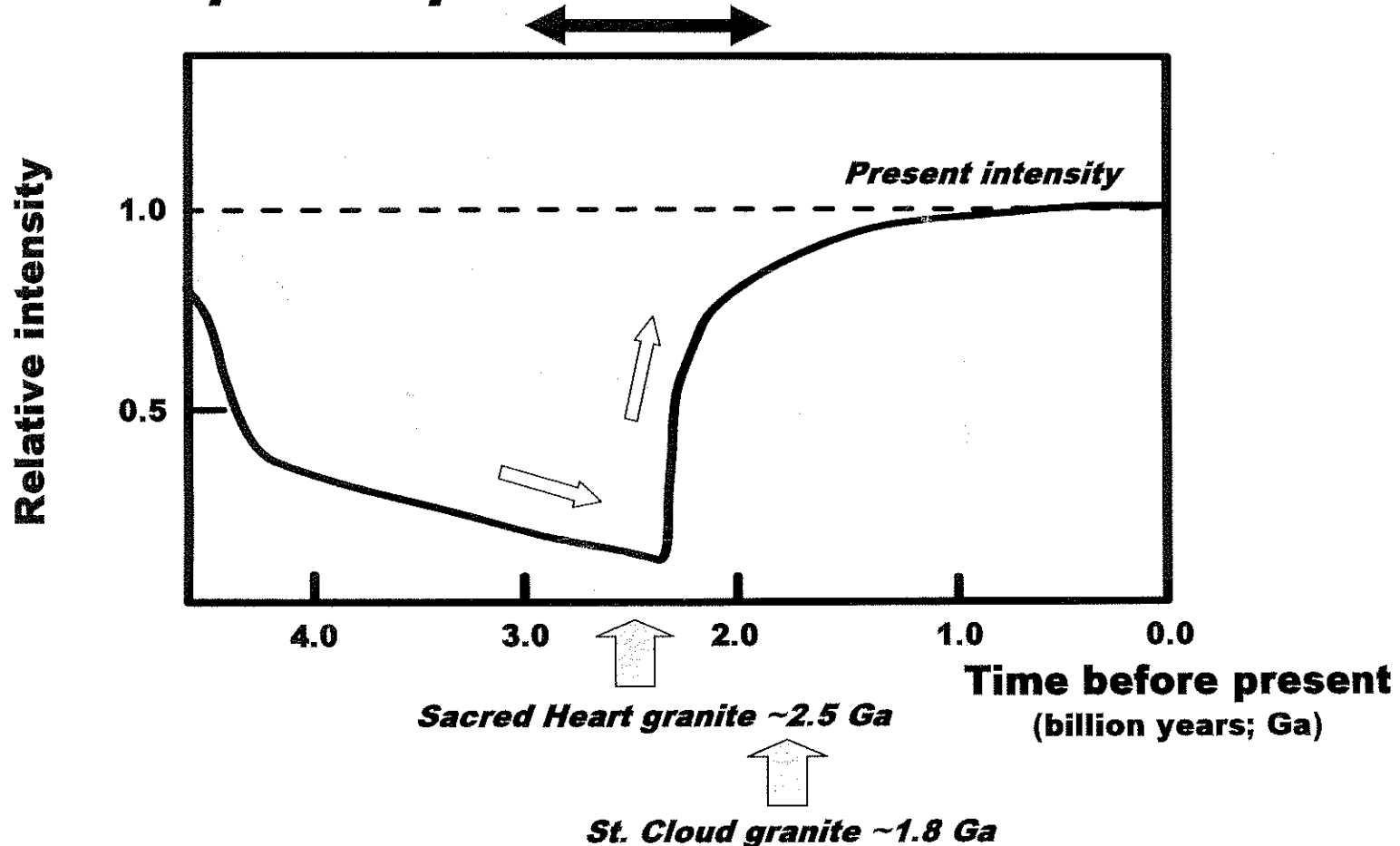
Magnetic Environment of the Earth in the space



The Earth's magnetic dipole:
When did it start?
How has it evolved?
What is its future?

Evolution model of the Earth's magnetic field — 2.5-billion-year-ago depression and recovery — (e.g. Stevenson, 1982; Hale et al., 1992)

Important period but a few reliable data!



Principles: how did granites record the geomagnetic field?

- **Fine grains of magnetic minerals in granites magnetized in parallel to the geomagnetic field during cooling time.**
- **Only very fine magnetic minerals can keep the stable magnetization for billion years.**
- **Now, granites possibly show the ancient geomagnetic field.**

Recipe: how to estimate the ancient geomagnetic field

- **Collect rock samples from the outcrops and take them to the laboratory.**
→ *This field work*
- **Heat samples stepwise by 600°C: e.g. 100,200,300, ...,550,600°C.**
- **Judge the stable magnetization which generally appears at high temperatures.**