The anomalies are measured with a proton precession magnetometer which measures field strength. Field direction is not measured. Note therefore if the field of the rock $H^R$ is 1 to the field of the earth $H^\oplus$, no anomaly is seen even if the direction of $H^R$ reverses from lineation to lineation.

Amplitude is measured: \[ \text{Anomaly} = \left| H^R + H^\oplus \right|^2 - \left| H^\oplus \right|^2 \]

Now suppose we use a cartesian coordinate system with $z$ vertical, $y$ oriented 11 to ridge axis.

Then the earth's field will be

\[
\begin{align*}
H_y^\oplus &= H^\oplus \sin I \\
H_x^\oplus &= H^\oplus \cos I \cos (C-D) \\
H_y^\oplus &= H^\oplus \cos I \sin (C-D)
\end{align*}
\]

where $I$ = magnetic inclination (\(\gamma\) from horizontal that field vector points) \\
$D$ = declination (\(\gamma\) from north that vector points) \\
$C$ = angle from $x$ to north

Now since the magnetized blocks that cause the anomalies are taken to be infinitely long $H_y^R = 0$. The field lines cannot escape the block, the anomaly is then

\[
A = (H^R + H^\oplus) \cdot (H^R + H^\oplus) - H^\oplus \cdot H^\oplus
\]

\[
= H^R \cdot H^R + H^\oplus \cdot H^\oplus + 2H^R \cdot H^\oplus - H^\oplus \cdot H^\oplus
\]

\[
= 2H^R \cdot H^\oplus \quad \text{since} \quad H^R, H^R \text{ is very small.}
\]
the anomaly is then given by

\[ A = 2H^0 \left[ H_x^R \sin I + H_x^R \cos I \cos (C-D) \right] \]

**Special cases:**

**Near equator**

\[ A \propto H_x^R \cos I \cos (C-D) \]

**Near poles**

\[ A \propto H_x^R \sin I \]

**No declination on ridge strikes N-S**

\[ A \propto H_x^R \sin I \]
Example 1

Suppose a ridge is striking N-S. It forms at latitude 40°S. We examine one magnetized block.

When rock was normal, the anomalies across the ridge look like:

Now move the block further north. As this is done, the inclination approaches 0° at the equator. Sin I also → 0 and the anomalies disappear above the equator. Inclination is negative and so are the anomalies.
EXAMPLE #2

Ridge striking W-E forms at 40°S and then moves north 90° rotating.

\[
H_x = H_x = \text{positive} \\
H_x = H_x = \text{positive} \\
H_x = 0 \\
C = 0°
\]

As we move the block north we decrease the inclination. This decreases the first term but increases the second. Above the equator the first term becomes increasingly negative and the second, although always + becomes smaller and smaller. Somewhere in a northern latitute where the anomaly = 0