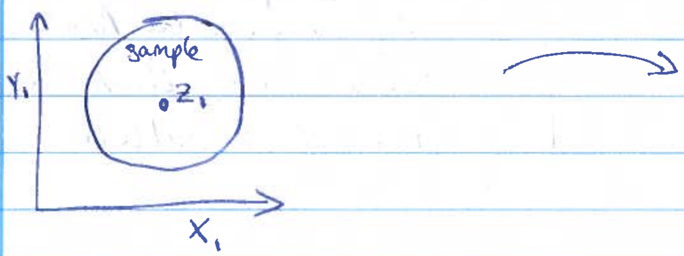
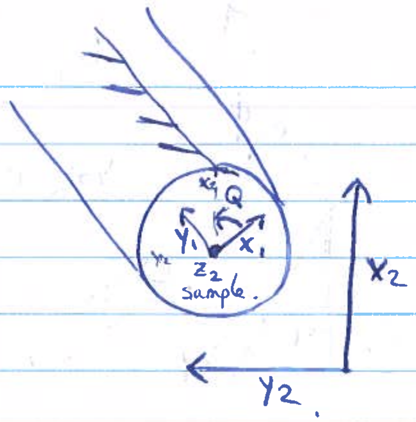
QDM Rotations

① QDM scan

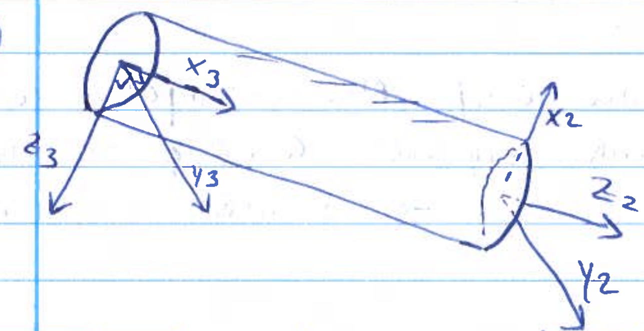




$$\begin{pmatrix} X_2 \\ Y_2 \\ Z_2 \end{pmatrix} = \begin{pmatrix} \cos Q & \sin Q & 0 \\ -\sin Q & \cos Q & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$

So $Q :=$ angle from horizontal to feather.
with counterclockwise (+)

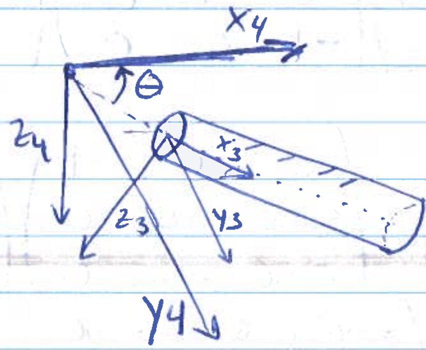
②



assumption
thinsection is taken from back-side core

$$\begin{pmatrix} X_3 \\ Y_3 \\ Z_3 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{pmatrix} \begin{pmatrix} X_2 \\ Y_2 \\ Z_2 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 1 \\ -\sin Q & \cos Q & 0 \\ -\cos Q & -\sin Q & 0 \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$

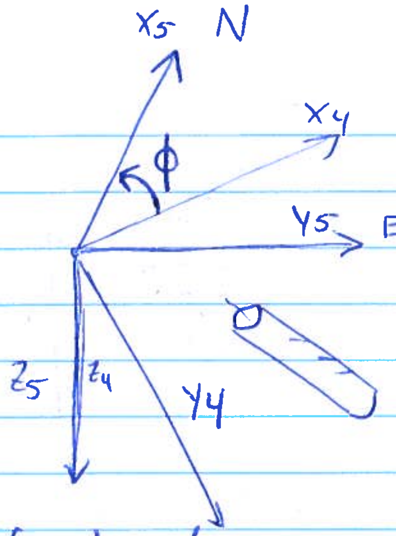
③



So $\Theta :=$ angle from core to horizontal with counterclockwise
i.e. into ground positive (+)
i.e. inclination

$$\begin{pmatrix} X_4 \\ Y_4 \\ Z_4 \end{pmatrix} = \begin{pmatrix} \cos\Theta & 0 & -\sin\Theta \\ 0 & 1 & 0 \\ \sin\Theta & 0 & \cos\Theta \end{pmatrix} \begin{pmatrix} X_3 \\ Y_3 \\ Z_3 \end{pmatrix} = \begin{pmatrix} \sin\Theta\cos Q & \sin\Theta\sin Q & \cos\Theta \\ -\sin Q & \cos Q & 0 \\ -\cos\Theta\cos Q & -\cos\Theta\sin Q & \sin\Theta \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$

(4)



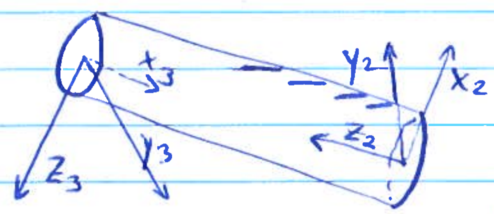
ϕ := angle from horizontally aligned core to North, where counterclockwise is (+)
i.e. declination

$$\begin{pmatrix} X_5 \\ \cancel{X}Y_5 \\ Z_5 \end{pmatrix} = \begin{pmatrix} \cos\phi & -\sin\phi & 0 \\ \sin\phi & \cos\phi & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} X_4 \\ Y_4 \\ Z_4 \end{pmatrix}$$

$$\begin{pmatrix} X_5 \\ Y_5 \\ Z_5 \end{pmatrix} = \begin{pmatrix} \cos\phi\sin\theta\cos\phi + \sin\phi\sin Q & \cos\phi\sin\theta\sin Q - \sin\phi\cos Q & \cos\phi\cos\theta \\ \sin\phi\sin\theta\cos\phi - \cos\phi\sin Q & \sin\phi\sin\theta\sin Q + \cos\phi\cos Q & \sin\phi\cos\theta \\ -\cos\theta\cos Q & -\cos\theta\sin Q & \sin\theta \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$

(*) What if thin section not mirrored:

(2*)



$$\begin{pmatrix} X_3 \\ Y_3 \\ Z_3 \end{pmatrix} = \begin{pmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{pmatrix} \begin{pmatrix} X_2 \\ Y_2 \\ Z_2 \end{pmatrix}$$

$$\begin{pmatrix} X_3 \\ Y_3 \\ Z_3 \end{pmatrix} = \begin{pmatrix} 0 & 0 & -1 \\ \sin Q & -\cos Q & 0 \\ -\cos\theta & -\sin Q & 0 \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$

(3*)
$$\begin{pmatrix} X_4 \\ Y_4 \\ Z_4 \end{pmatrix} = \begin{pmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{pmatrix} \begin{pmatrix} X_3 \\ Y_3 \\ Z_3 \end{pmatrix} = \begin{pmatrix} \sin\theta\cos Q & \sin\theta\sin Q & -\cos\theta \\ \sin Q & -\cos Q & 0 \\ -\cos\theta\cos Q & -\cos\theta\sin Q & -\sin\theta \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$

(4*)
$$\begin{pmatrix} X_5 \\ Y_5 \\ Z_5 \end{pmatrix} = \begin{pmatrix} \cos\phi\sin\theta\cos\phi - \sin\phi\sin Q & \cos\phi\sin\theta\sin Q + \sin\phi\cos Q & -\cos\phi\cos\theta \\ \sin\phi\sin\theta\cos\phi + \cos\phi\sin Q & \sin\phi\sin\theta\sin Q - \cos\phi\cos Q & -\sin\phi\cos\theta \\ -\cos\theta\cos Q & -\cos\theta\sin Q & -\sin\theta \end{pmatrix} \begin{pmatrix} X_1 \\ Y_1 \\ Z_1 \end{pmatrix}$$