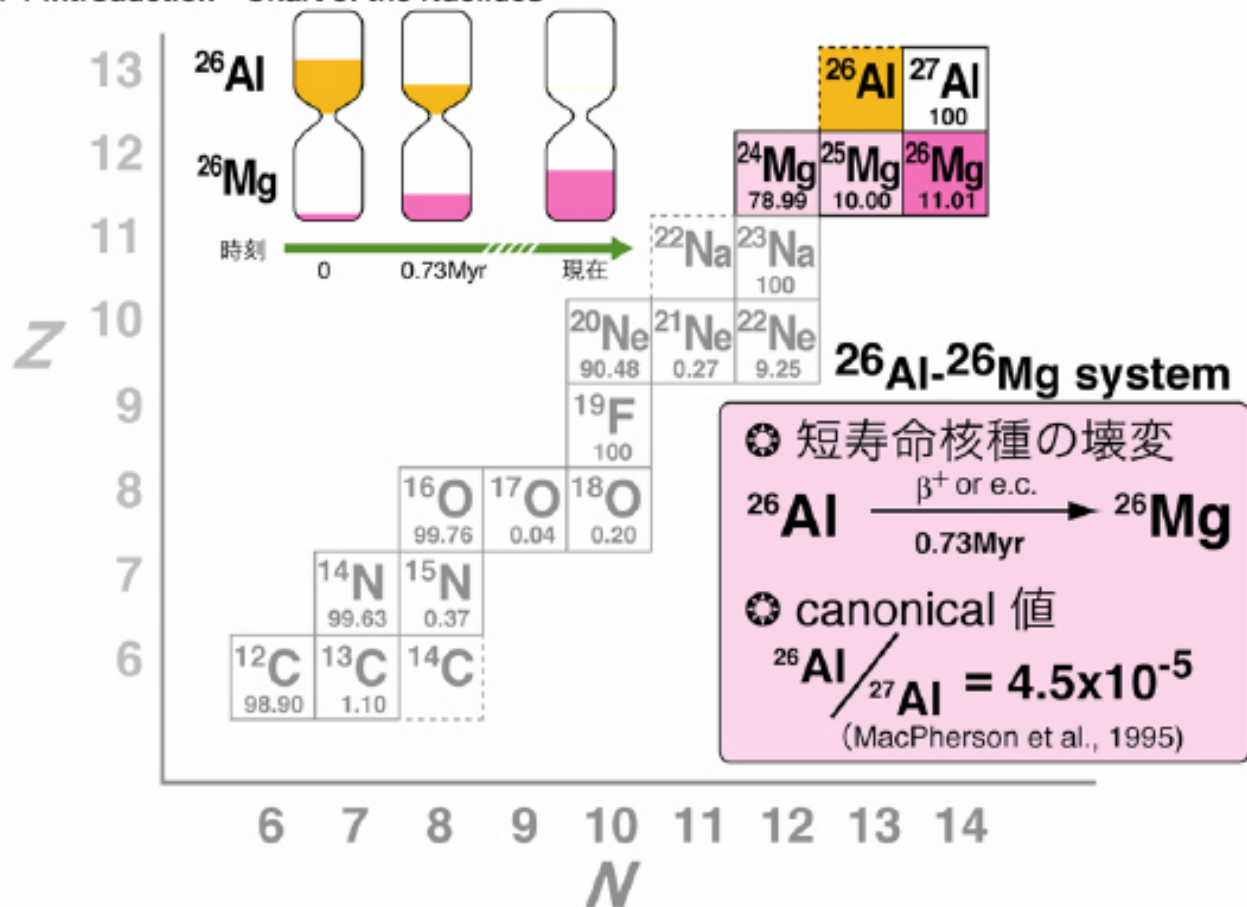


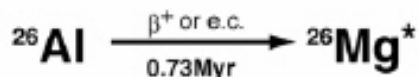
マグネシウム同位体

Chapter 1 Introduction Chart of the Nuclides

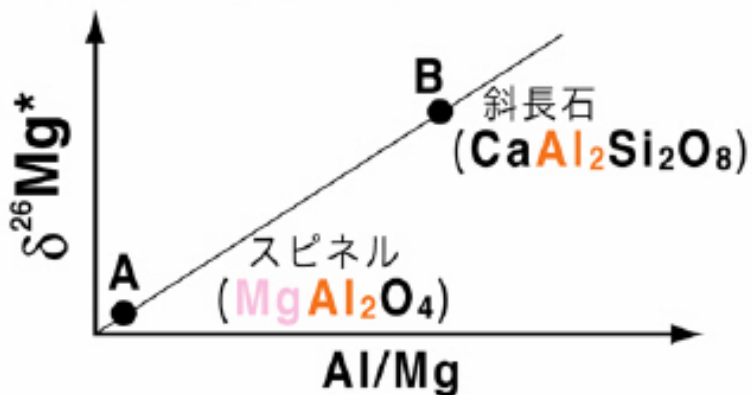


アイソクロン (同時刻に結晶化した鉱物に対して)

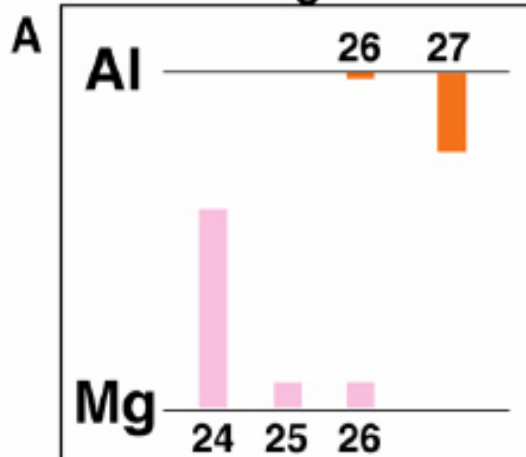
Chapter 1 Introduction



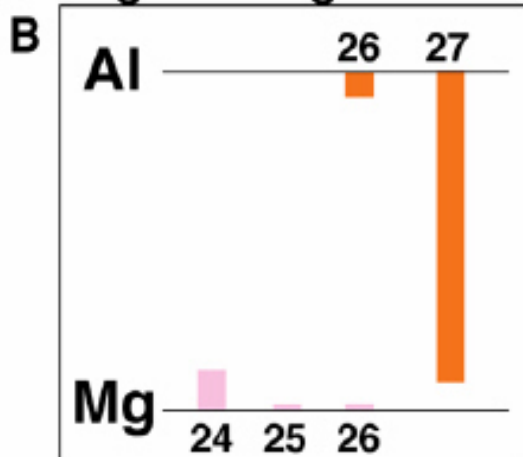
同じ時刻に結晶化したとき



A Low-Al/Mg mineral

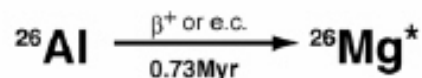


B High-Al/Mg mineral

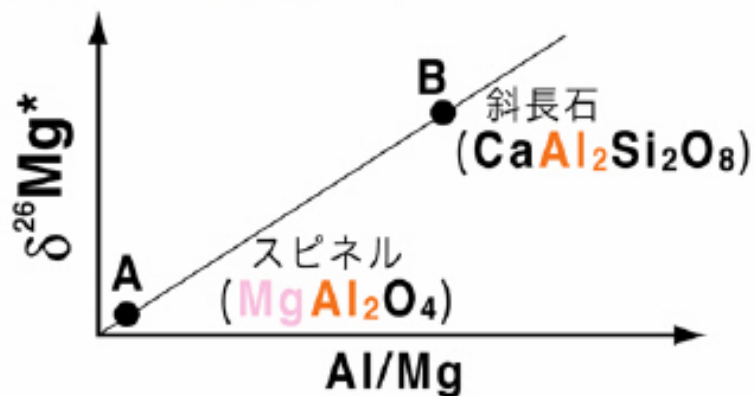


アイソクロン (同時刻に結晶化した鉱物に対して)

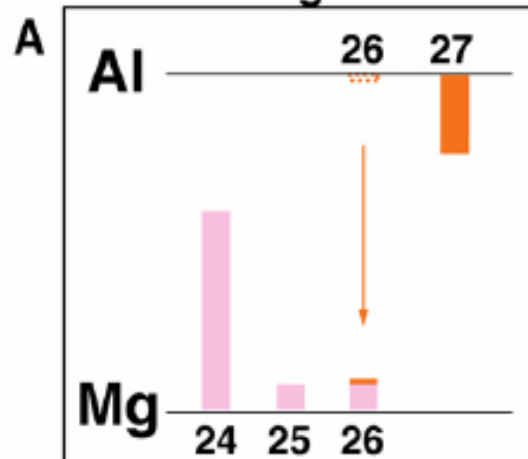
Chapter 1 Introduction



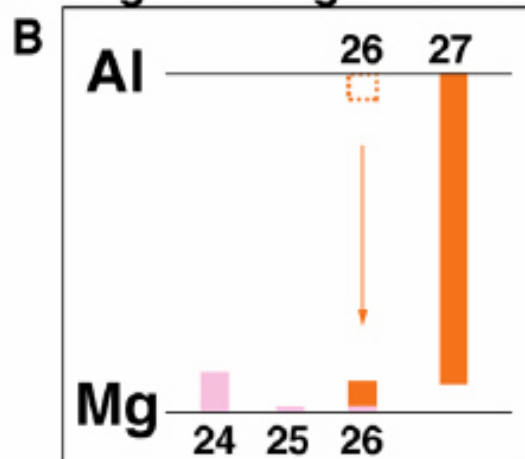
同じ時刻に結晶化したとき



Low-Al/Mg mineral

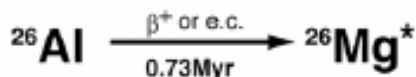


High-Al/Mg mineral

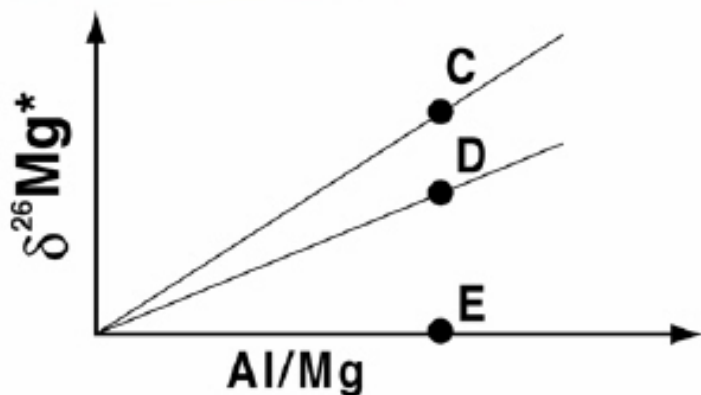
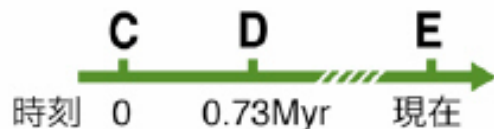


アイソクロン (同じ Al/Mg 比を持つ鉱物に対して)

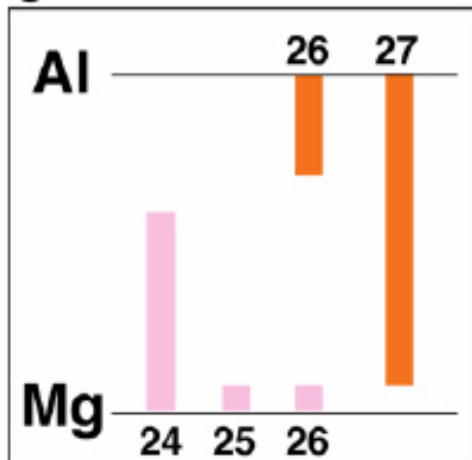
Chapter 1 Introduction



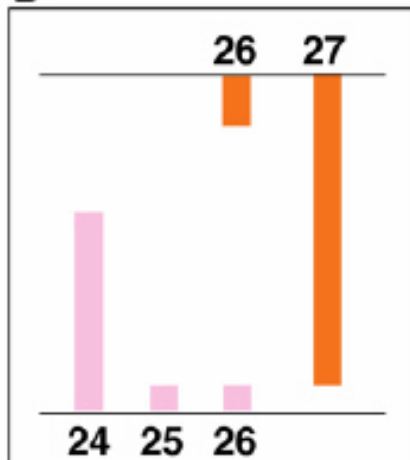
結晶化時刻が異なるとき



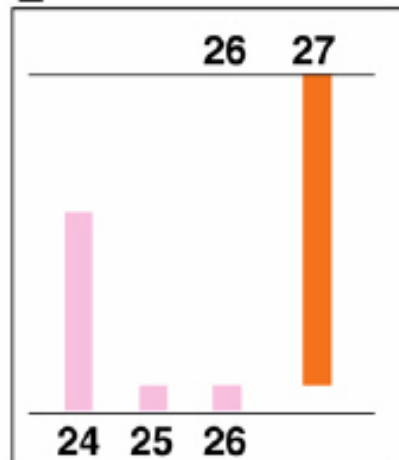
C



D

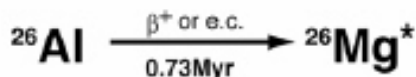


E

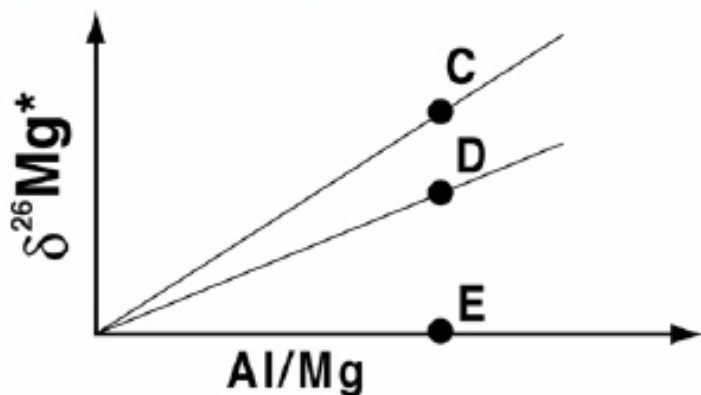
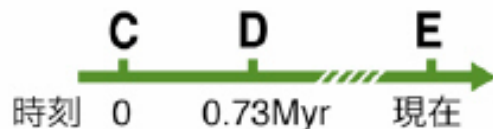


アイソクロン (同じ Al/Mg 比を持つ鉱物に対して)

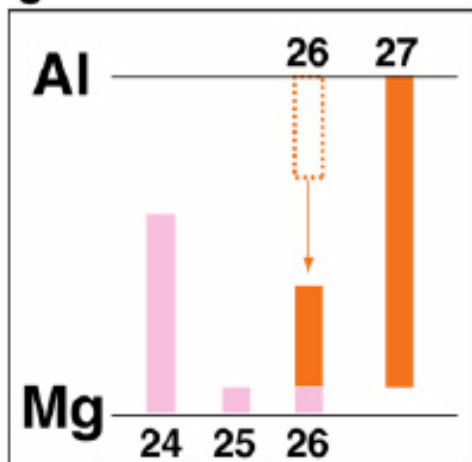
Chapter 1 Introduction



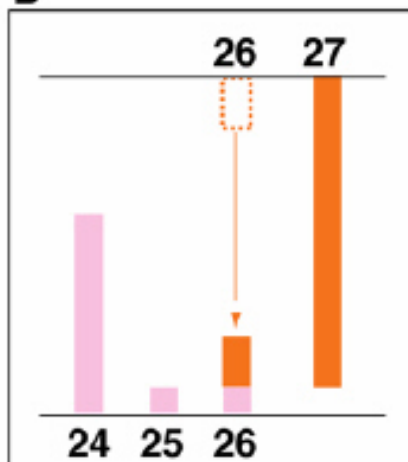
結晶化時刻が異なるとき



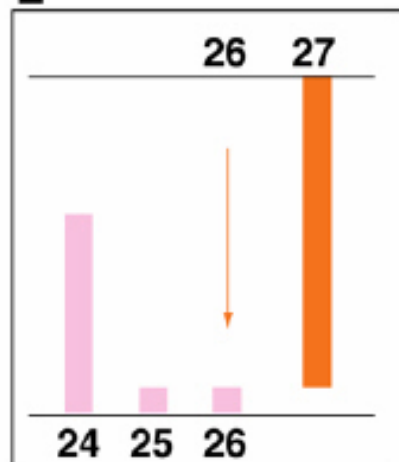
C



D



E

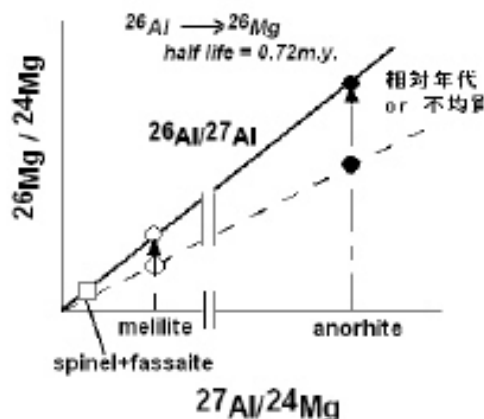
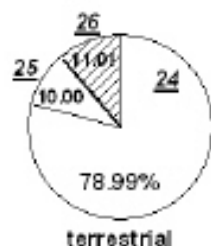
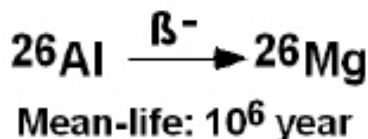


短寿命核種の年代学

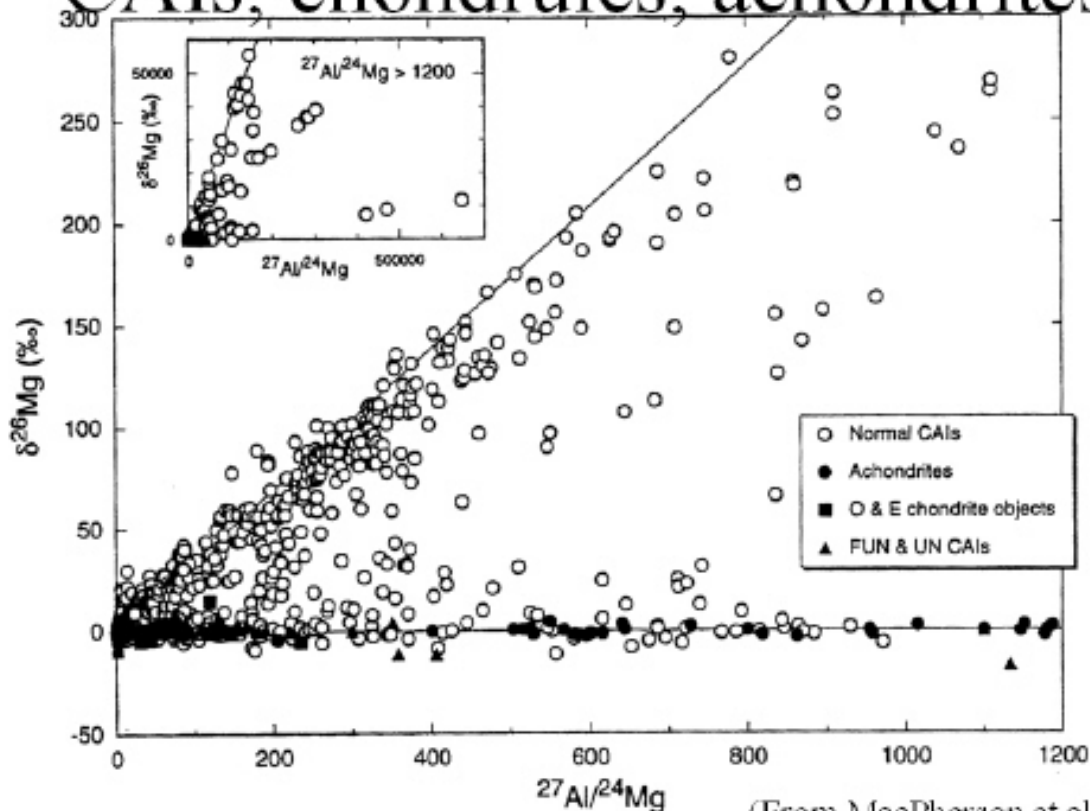
$$\frac{N_d}{N_d^s} - \frac{N_d^0}{N_d^s} = \frac{N_0}{N_d^s} (1 - e^{-\lambda t})$$

$$\frac{N_d}{N_d^s} - \frac{N_d^0}{N_d^s} = \frac{N_0}{N^s} \frac{N_0^s}{N_d^s}$$

$$\Delta t_{1-2} = \frac{1}{\lambda} \left\{ \ln \left(\frac{N_0}{N^s} \right)_1 - \ln \left(\frac{N_0}{N^s} \right)_2 \right\}$$

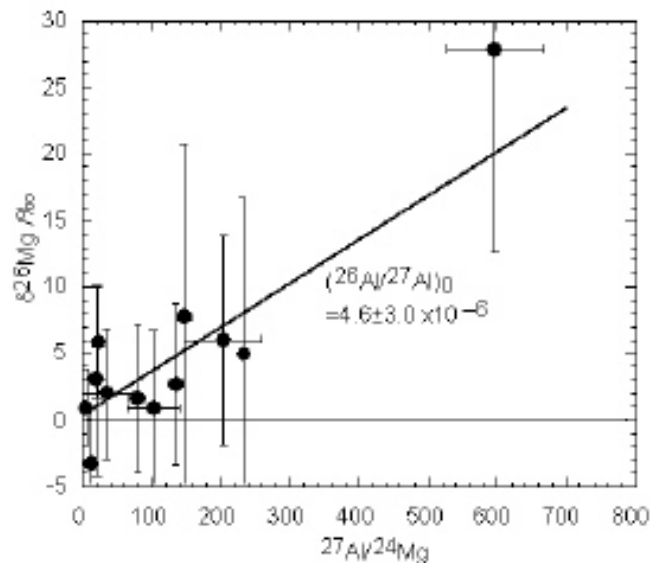
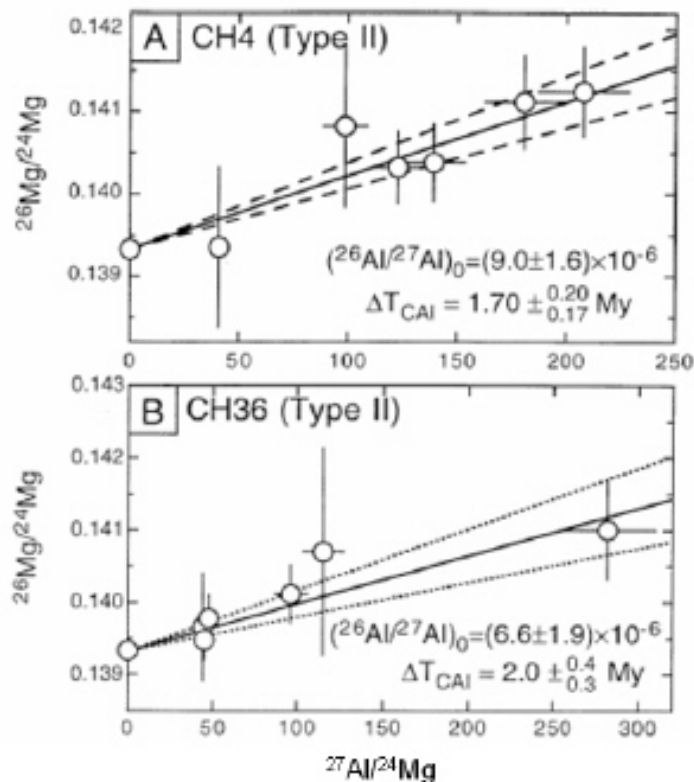


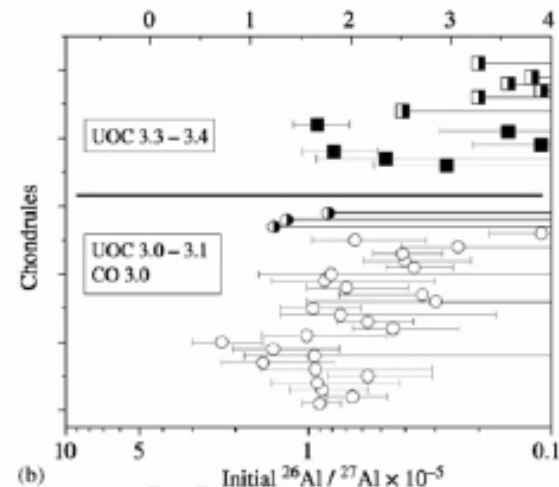
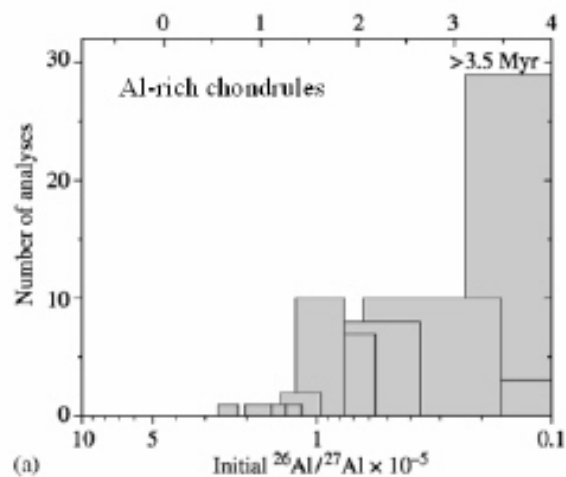
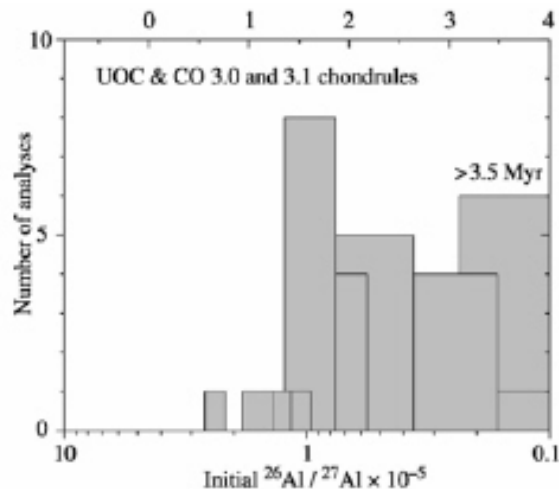
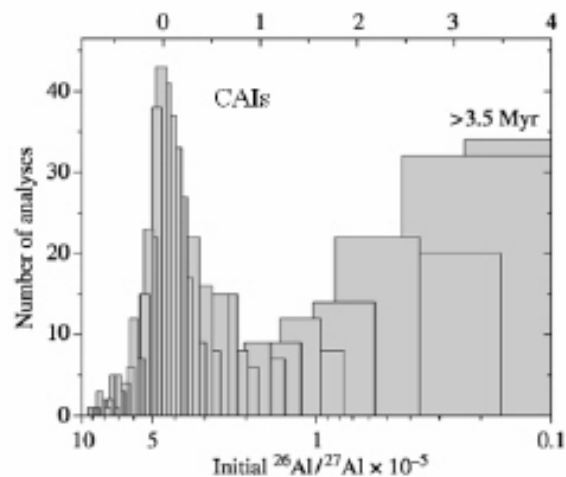
CAIs, chondrules, achondrites



(From MacPherson et al., 1995)

^{26}Al in chondrules





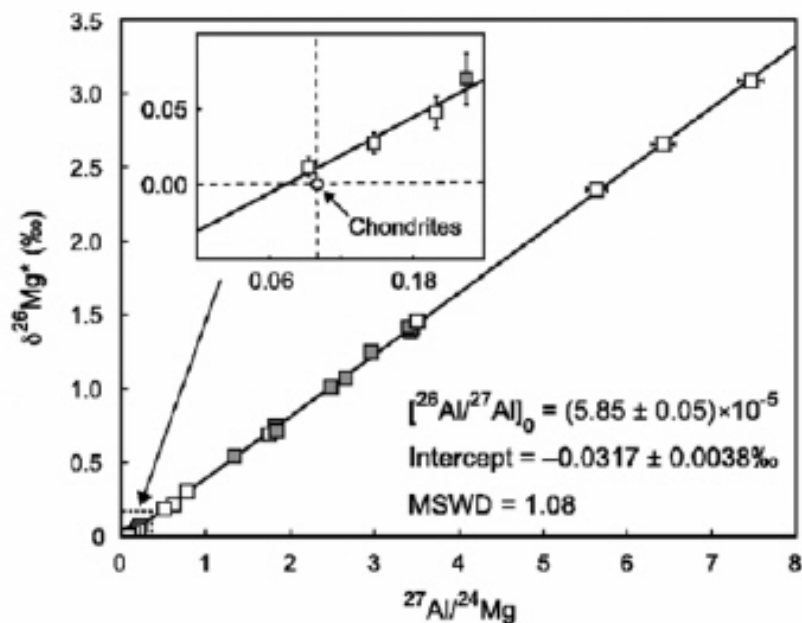
(a)

(b)

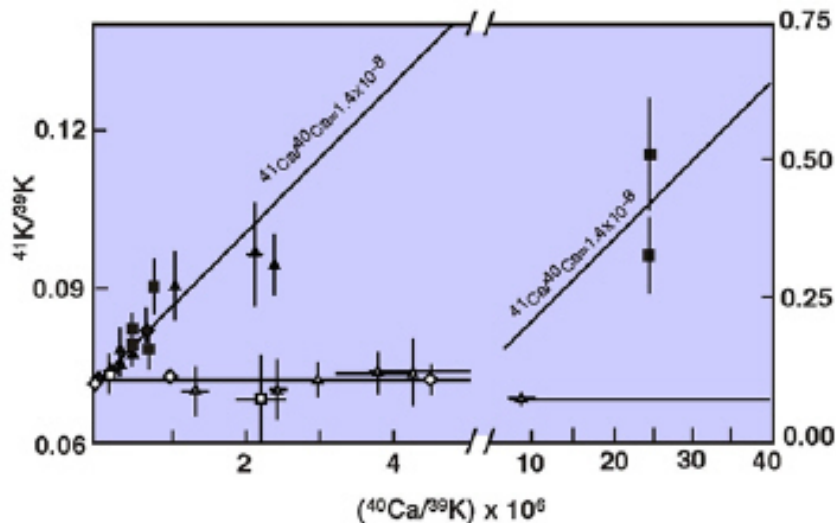
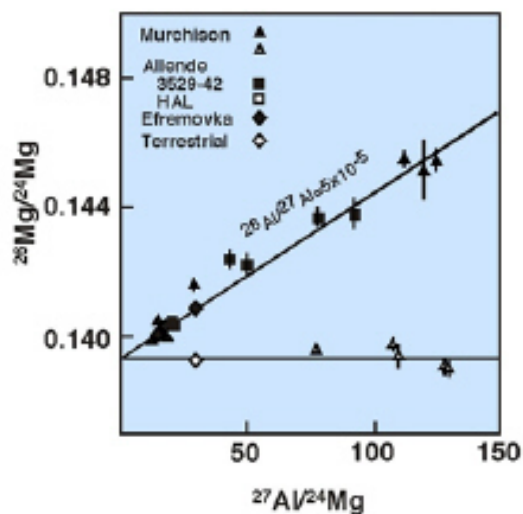
形成年代

Mckeeagan and Davis (2003)

CAI前駆物質の ^{26}Al

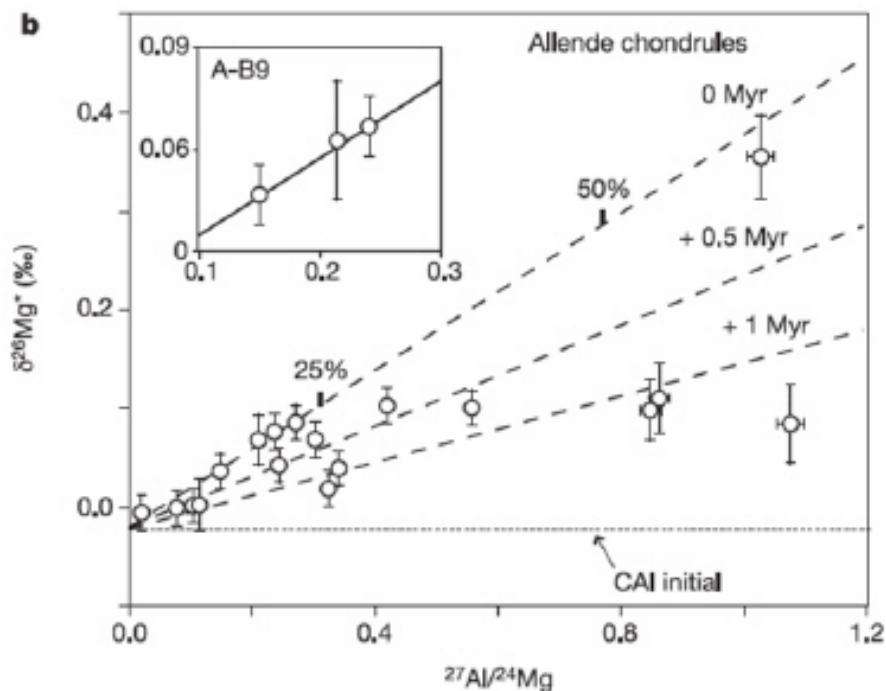


^{26}Al and ^{41}K in CAI

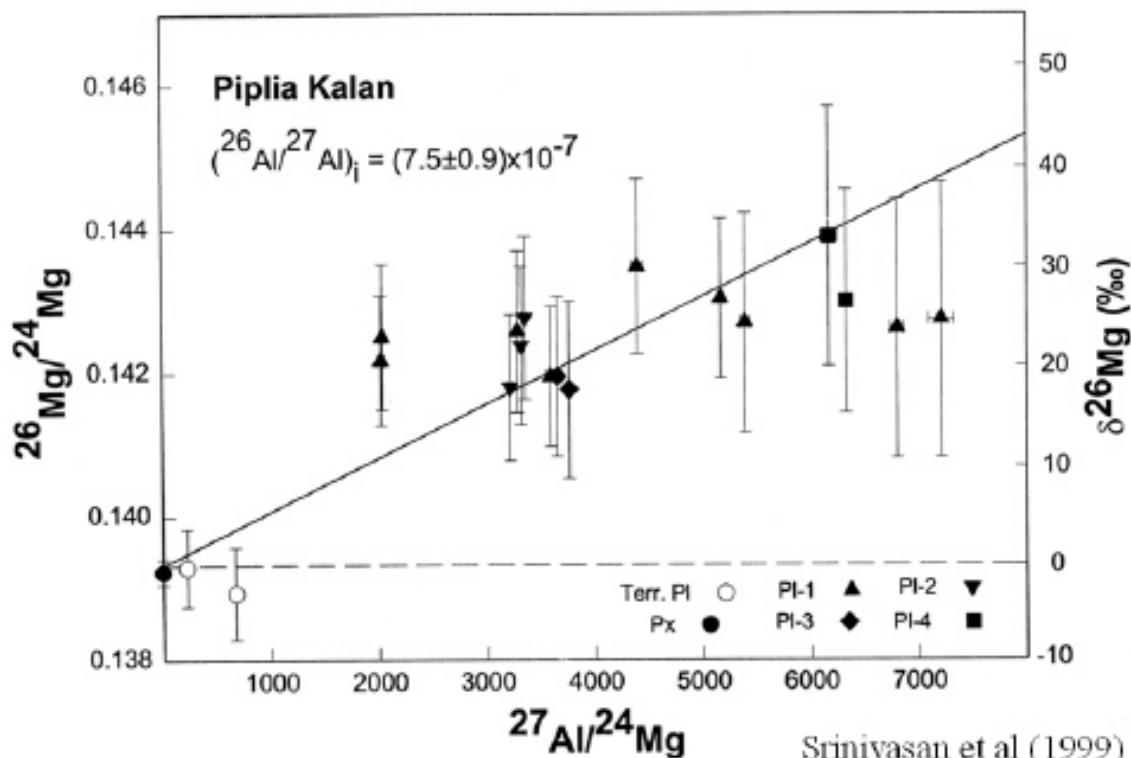


Sahijpal et al. (1998)

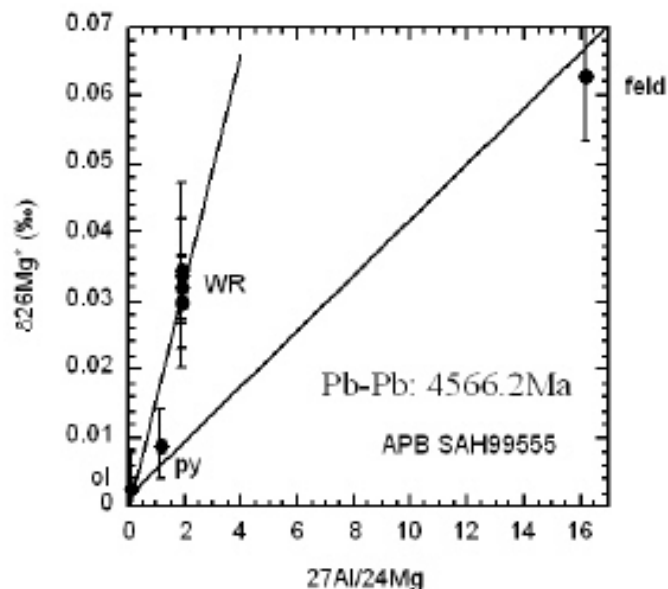
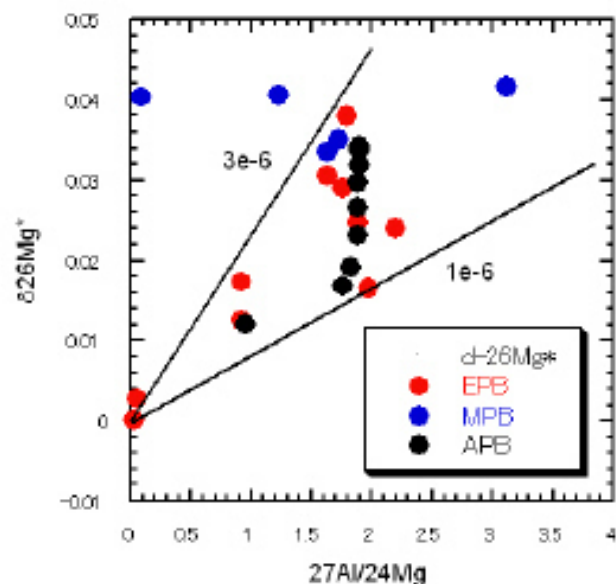
chondrule前駆物質の ^{26}Al



^{26}Al in eucrite

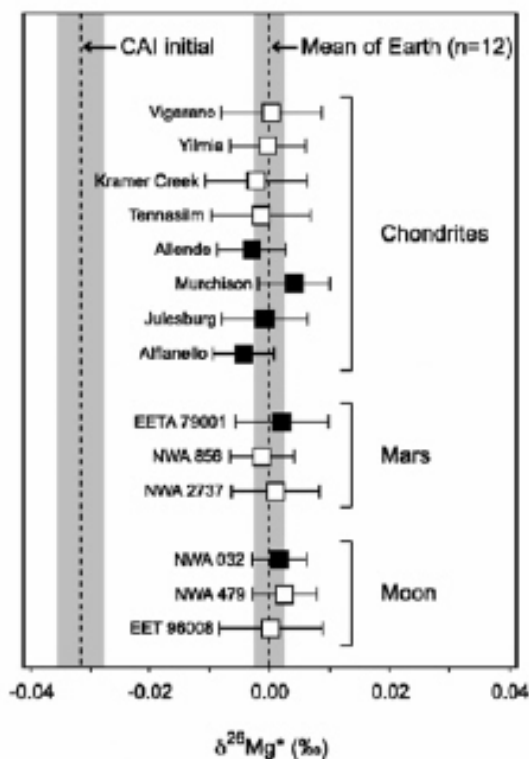


Achondrite $\delta^{26}\text{Al}$

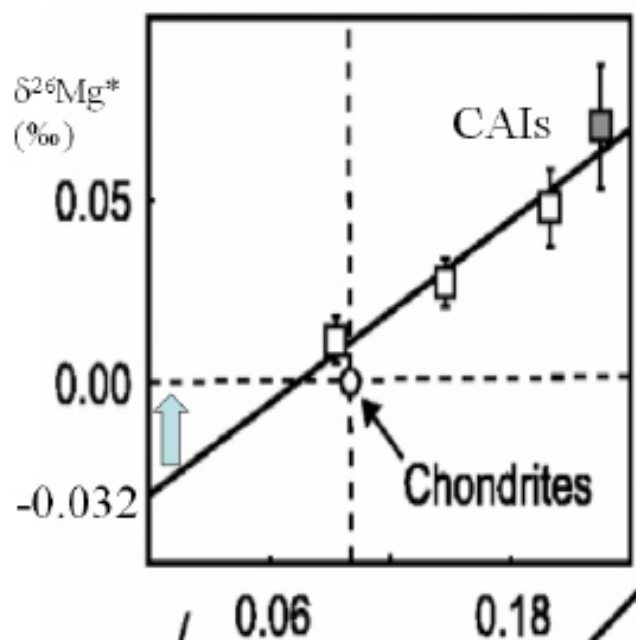


$\Delta t_{\text{CAI}} \sim 3-4 \text{ Myr}$

惑星物質の ^{26}Al



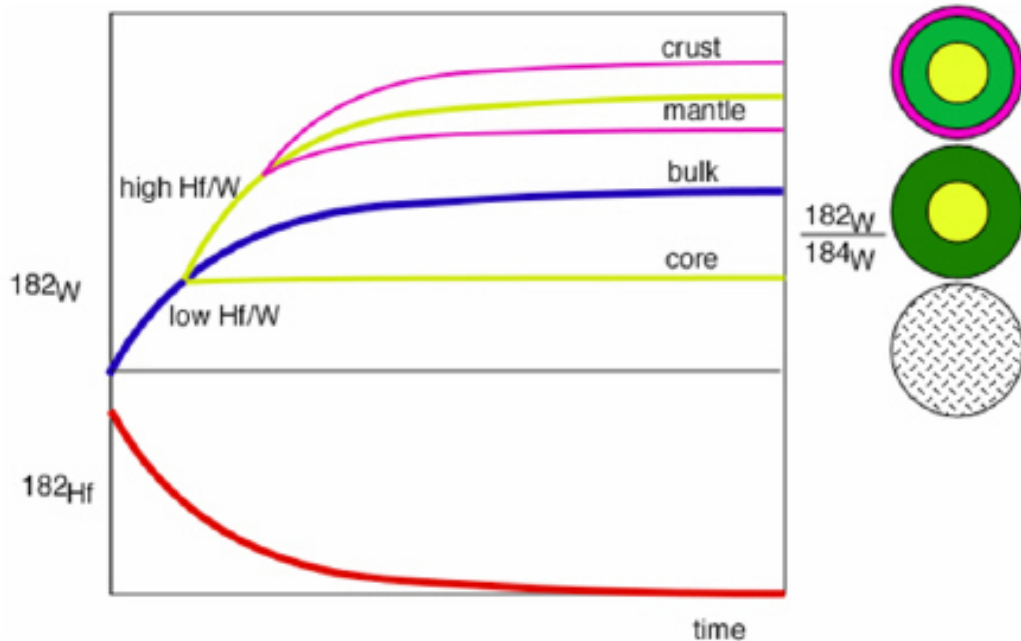
Achondriteの $\delta^{26}\text{Mg}^*$



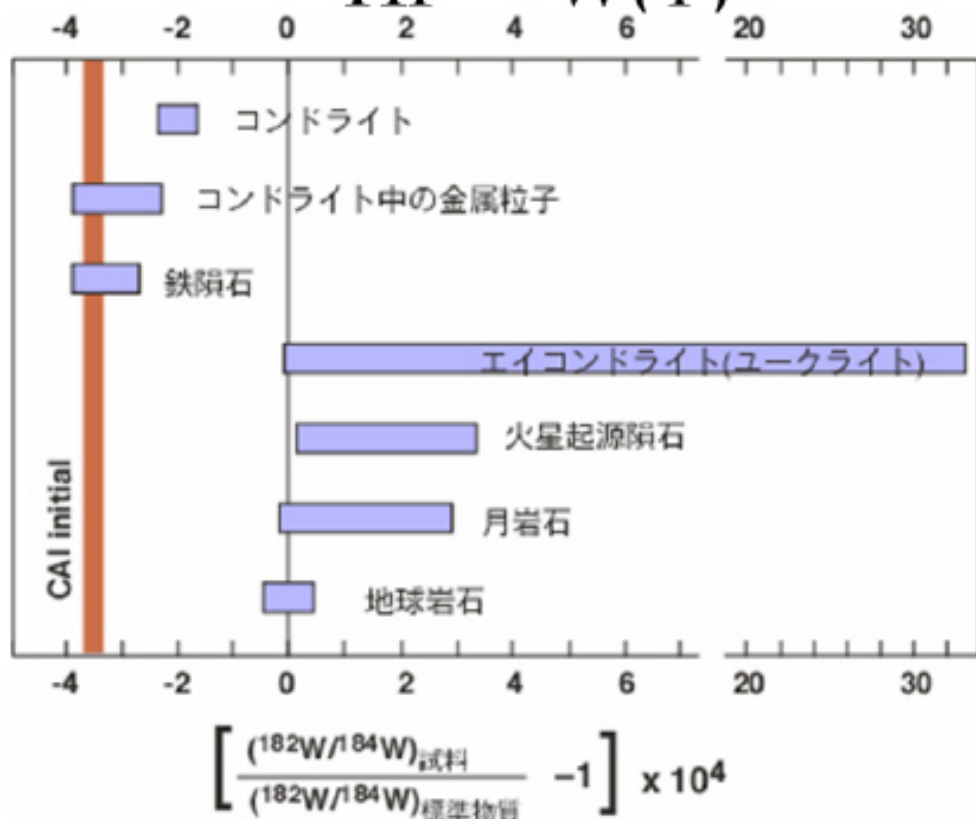
- Ol in Pal: $-0.022(8)\text{‰}$
- Δt_{CAI} (Myr) of ol, px
 - Pallasite: ~ 0.8
 - Core formation
 - Aubrite: ~ 1.0
 - Magma ocean
 - Ureirite: 0.5
 - Partial melt residue

Baker and Bizzarro (2005)
Tomiyama et al. (2006)

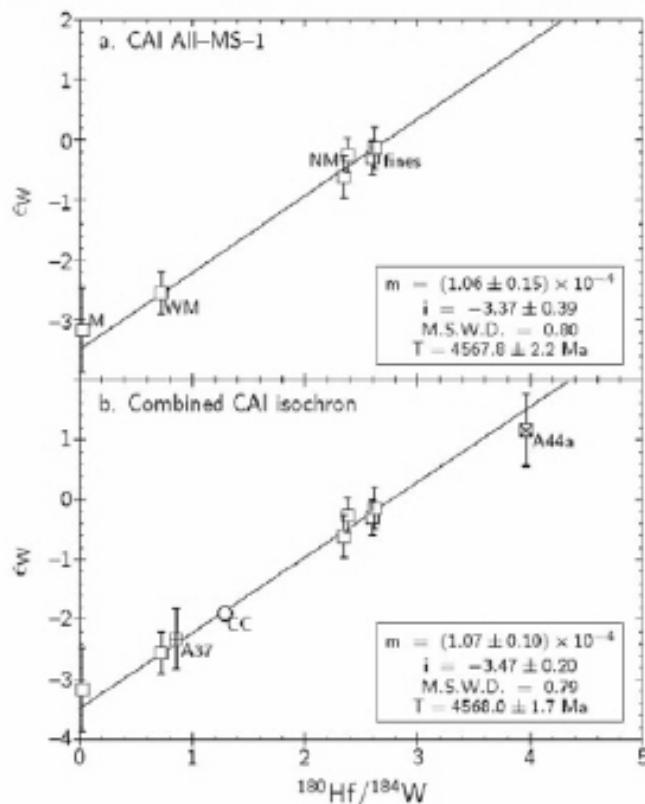
^{182}Hf - ^{182}W



$^{182}\text{Hf}-^{182}\text{W}(1)$



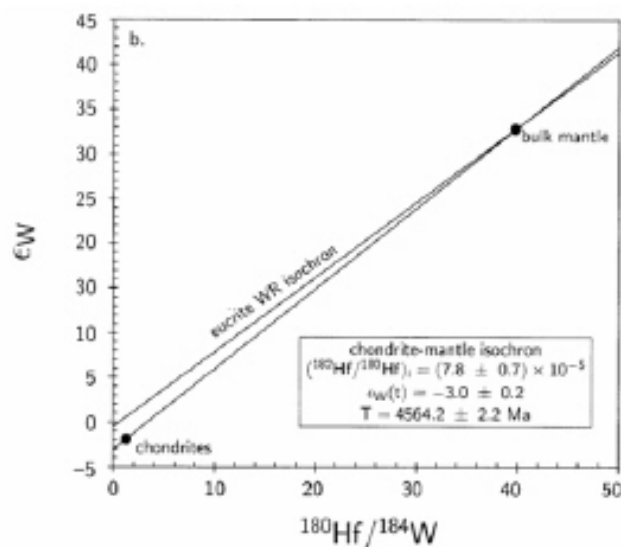
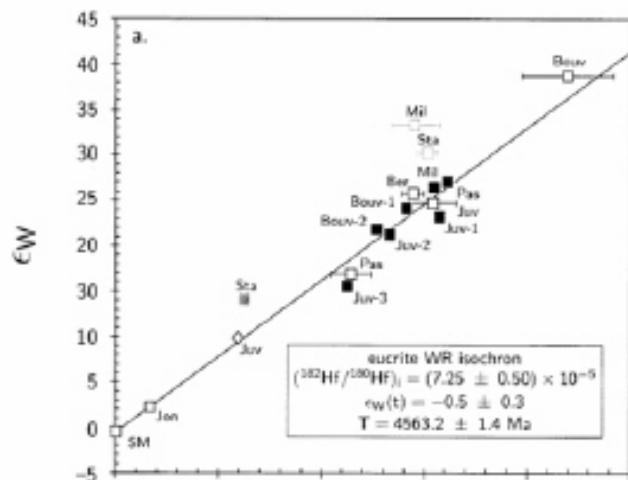
太陽系 $\epsilon^{182}\text{W}$, $182/180\text{Hf}$ 初期値



$^{182}\text{Hf}-^{182}\text{W}$

- Chondrite
 - 太陽系の平均値
- Iron meteorite
 - 太陽系初期値と同じ値は初期分化を示す
 - 原始惑星形成は100万年以内
- Metal in chondrite
 - 金属とケイ酸塩の分化が微惑星形成以前
 - Chondrule formation時か？
- 火星・月・地球
 - 中心核形成は3000万年以内

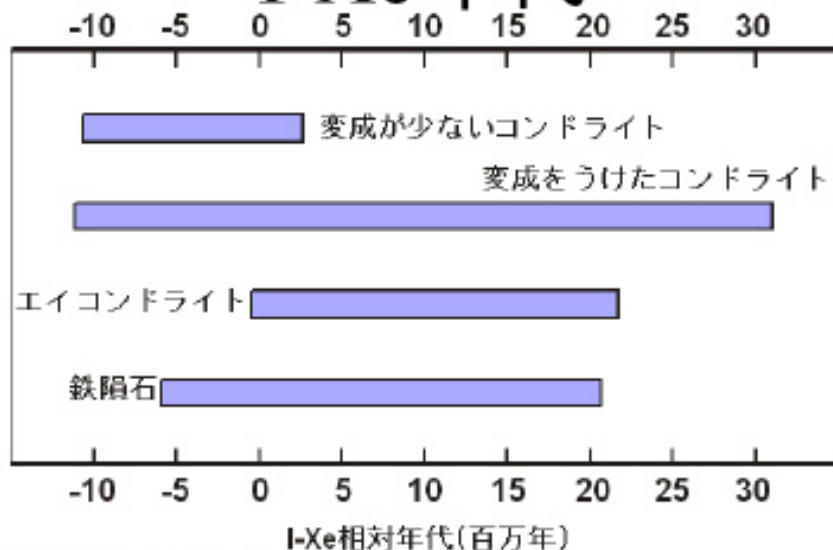
Vestaの核形成とマントル分化



^{129}I - ^{129}Xe

- I
 - 揮発性元素
 - 低温では固体に固定
- Xe
 - 気体, 極低温では固体
 - 少しの加熱で逃散
- リセットされやすい
- 星間雲中や分子雲中の歴史を記録

I-Xe年代



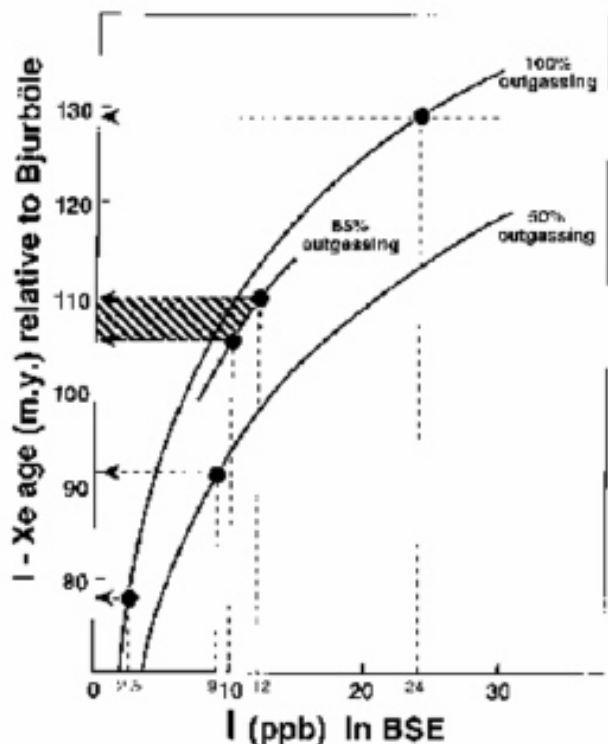
- 0=原始惑星形成年代
- 原始惑星形成以前：1000万年
 - 星間雲が分子雲を形成し原始惑星に進化する期間
 - 母分子雲の年齢：数100万年

$^{129}\text{I}/^{127}\text{I}$ の初期値

- $(^{129}\text{I}/^{127}\text{I})_0 \approx 10^{-4}$
- r 過程により生成： $^{129}\text{I}/^{127}\text{I} \approx 1$
 - 超新星爆発後1-2億年に形成した物質
- 星間塵の平均寿命：5億年（小笹私信）
- 1-2億年：太陽系をつくった星間塵の形成期間
- 星間雲同士の衝突頻度： 10^7 年
 - 1-2億年で10-20回の衝突
 - 太陽系の同位体比均一性 ($< 0.1\% @ 1\text{mm}^3$)
 - 億年オーダーの物質混合・結晶成長の結果???

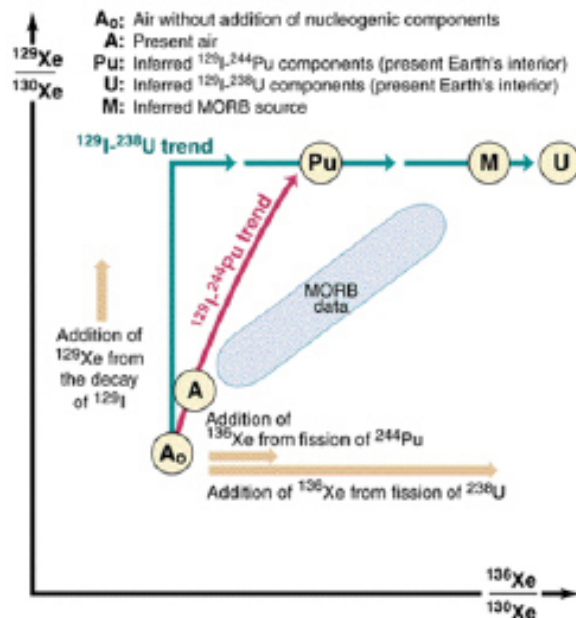
地球のXeの過剰

- ^{129}Xe の過剰(Allégre et al., 1995)
 - 地球大気 : $3.63 \times 10^{13}\text{g}$ の ^{129}I 起源Xe
 - I: 地球全体 $4.1\text{-}4.9 \times 10^{19}\text{g}$
 - 地球大気の形成 : 原始惑星形成後約1億年後



地球のXeの過剰

- ^{136}Xe の過剰(Kunz et al., 1998)
 - マントル中のXe同位体比
 - ^{129}I と ^{244}Pu の寄与
 - 地球大気形成開始：原始惑星形成後5000-7000万年後
 - その後、2000万年間で大気の80%脱ガス



Kaneoka (1998)

