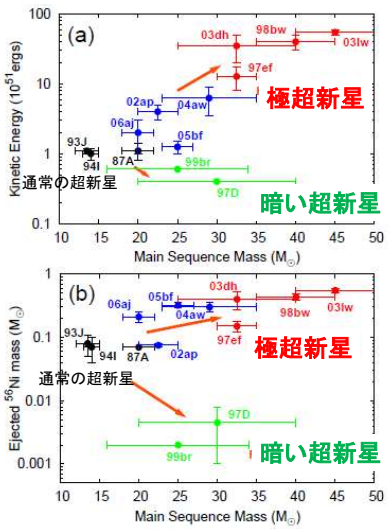

重力崩壊型
超新星の多様性
（現在の観測）

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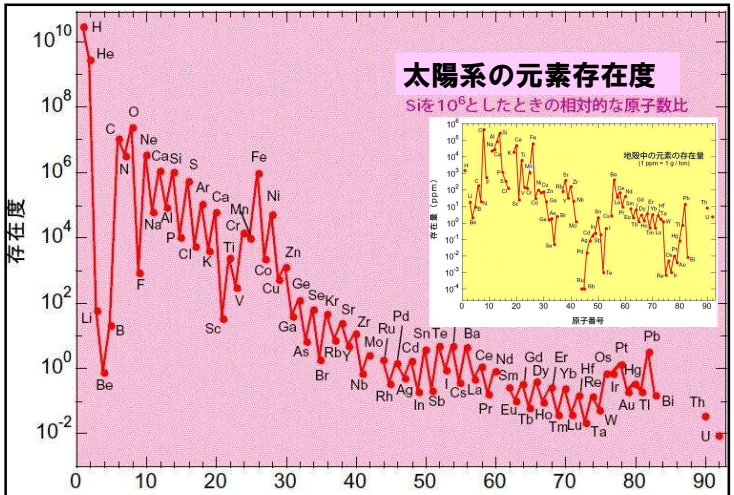

E.Anders & N.Grevesse (1989)

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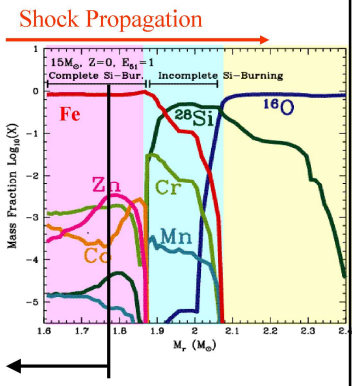
Explosive Nucleosynthesis

Post-shock T

$T \propto R^{-3/4}E^{1/4}$

- High T ($T>5\times10^9$K)
  Fe,α,Ti,Zn,Co,V
- Middle T ($>T>4\times10^9$K)
  Fe,Si,Cr,Mn
- Low T ($>T>3\times10^9$K)
  Si

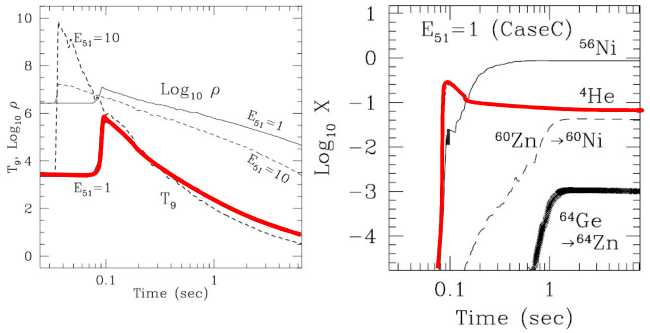


Mass Cut M_{cut}

The boundary between the ejecta and the central remnant

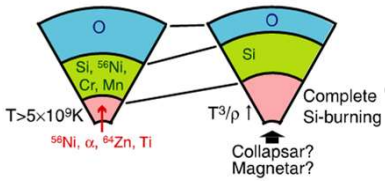
α-rich freeze out

NSE → α-rich freeze out



極超新星による爆発的元素合成

E~10^{51}erg → ~ 10^{52}erg



(1) M(Complete Si-burning) ↗

(Zn, Co)/Fe ↗

(Mn, Cr)/Fe ↘

Fe/(O, Si) ↗

(2) More α ⇐ entropy ↗

Zn/Fe ↗ ⇐ ^{64}Ge

Ti/Fe ↗

(3) More O burns

(Si, S, Ca)/O ↗

Low energy　　High energy

ふつうの超新星　極超新星

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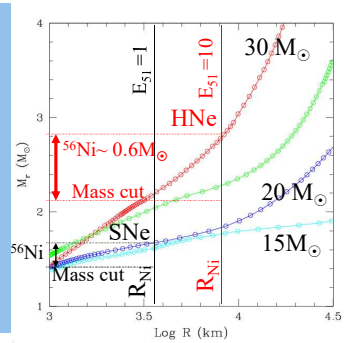
超新星親星の密度分布と爆発で作られる^{56}Ni

E=4πR^{3}aT^4/3 (爆発直後は放射エネルギー優勢)

(T>5・10^9Kで^{56}Niが多く作られる)　R_{Ni} ~ 3700$E_{51}^{1/3}$ (km)

通常の超新星の^{56}Niの放出量 ~ 0.07 M$_\odot$はM~15-20 M$_\odot$星の E_{51}=1の爆発で、

極超新星の^{56}Niの放出量 ~ 0.3-0.6 M$_\odot$はM~30 M$_\odot$星の E_{51}=10の爆発で説明できる。



Z=0.02 model

拡大図

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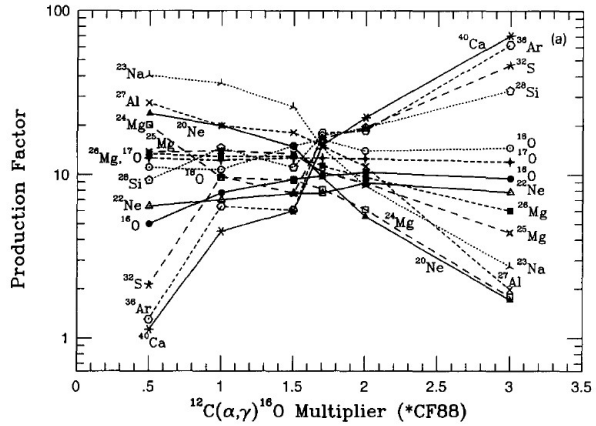
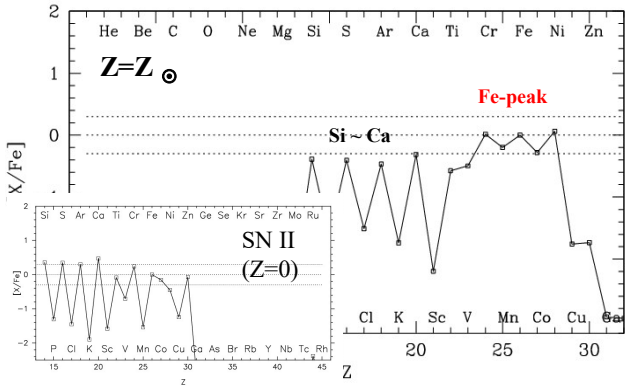
^{12}C(α、γ)^{16}O rate と 元素合成



(Weaver & Woosley 1993)

Ia型超新星 爆発的元素合成(太陽組成との比)



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