



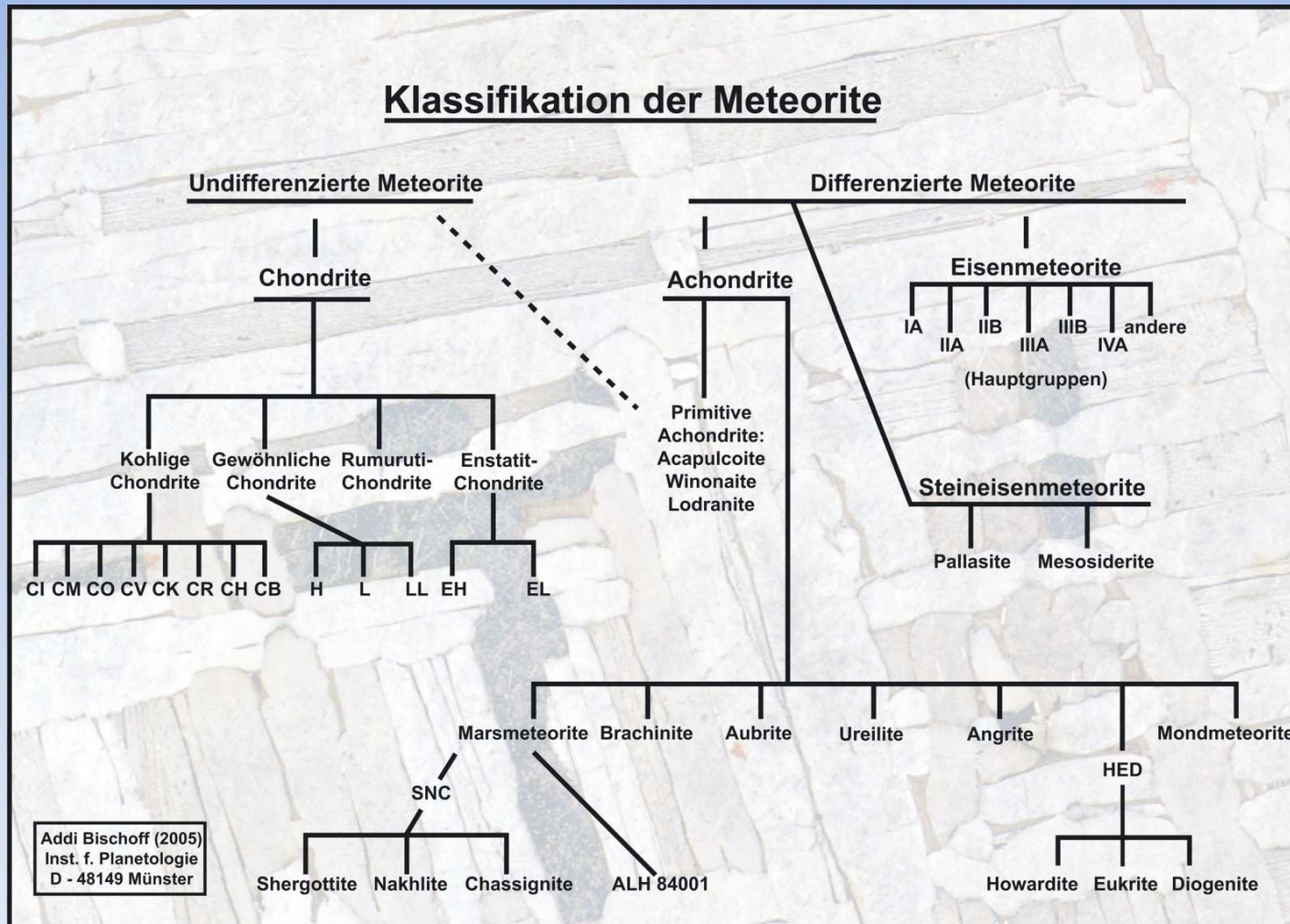
**Trace elements in
magmatic systems and geochemical
modelling
(an introduction)**

SUPPLEMENTARY INFORMATION

Jörg A. Pfänder

Brief excursion: Composition of the (bulk) Earth

Meteorites as witnesses of the early history of the solar system:



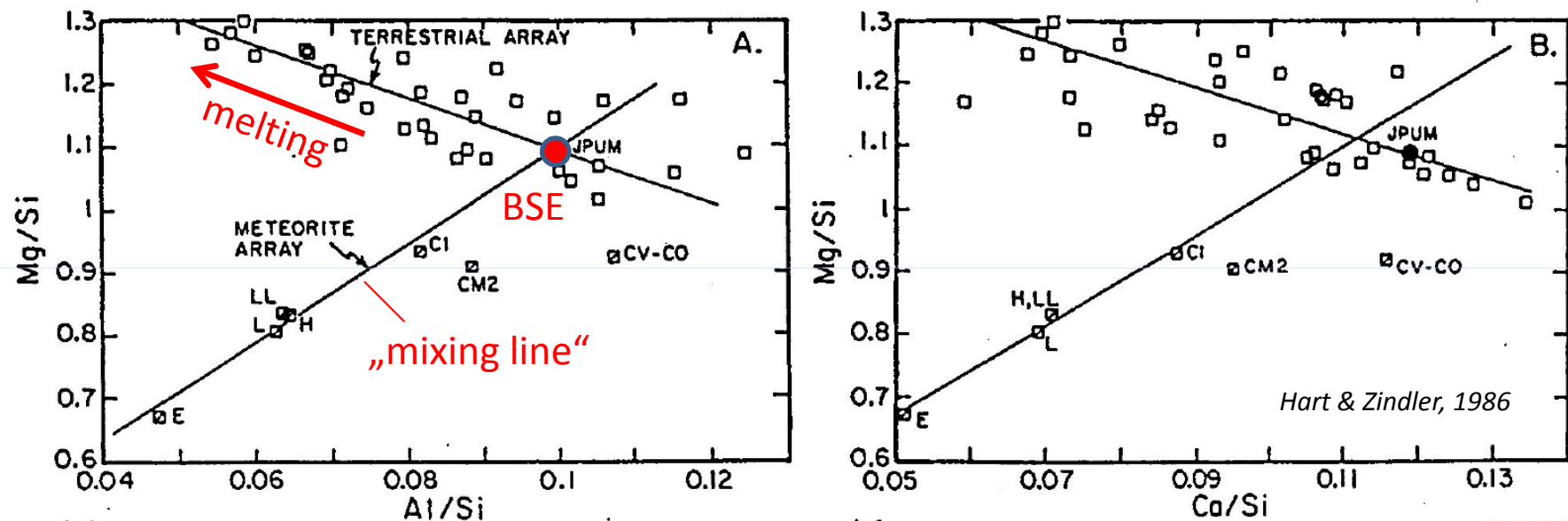
*Brief excursion: Composition of the (bulk) Earth***Approach 1: Composition of peridotites & peridotite derived melts (Ringwood):****PYROLITE model of Ringwood (1962, 1966):**

This model uses **concentrations** of chemical elements measured directly in mantle rocks, and corrects for melt extraction by „adding“ back basaltic melt.

„Mixing proportions“ between **lherzolite** and **basaltic melt** balanced to match the **chondritic REE abundance ratios!**

Brief excursion: Composition of the (bulk) Earth

Approach 2: Comparison of meteorites & peridotites:

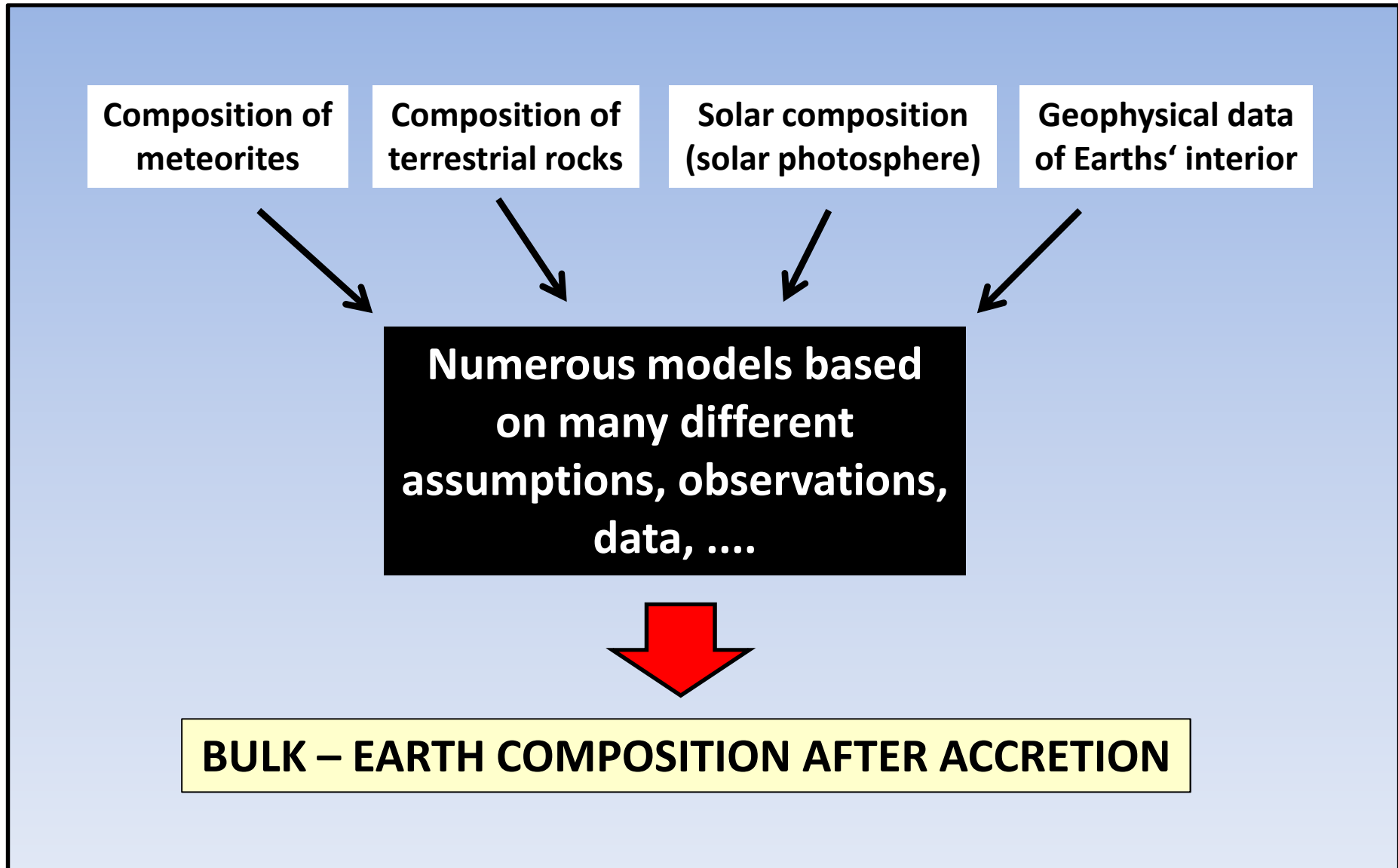


BSE (bulk-silicate Earth):

$Al/Si \approx 0.098$ and $Mg/Si \approx 1.1$ and $Ca/Si \approx 1.1$

Based on these values, abundances of other elements can be calculated from known chondritic abundances!

Brief excursion: Composition of the (bulk) Earth



Composition of meteorites

Composition of terrestrial rocks

Solar composition (solar photosphere)

Geophysical data of Earths' interior

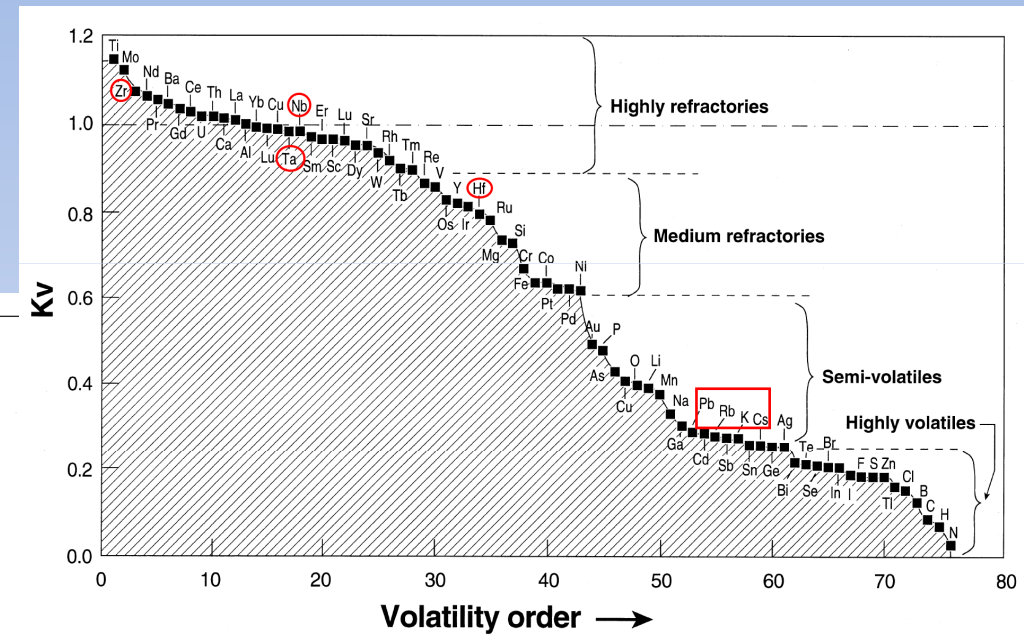
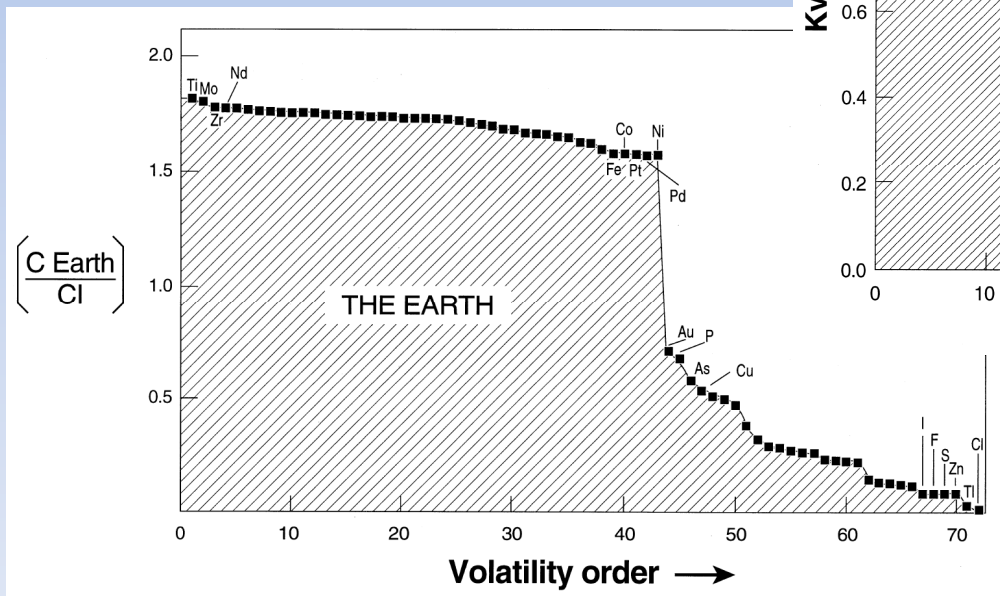
Numerous models based on many different assumptions, observations, data,

BULK – EARTH COMPOSITION AFTER ACCRETION

Brief excursion: Composition of the (bulk) Earth

Deviations from **solar** and **chondritic** abundances are explained by **different volatilities**:

Concentration of the elements in the bulk Earth relative to CI chondrites



Allègre et al., 2001, Earth Planet. Sci. Lett.

Brief excursion: Composition of the (bulk) Earth

Concentration anomalies observed for specific elements in the silicate portion of the Earth (BSE) are explained by specific **partitioning behaviour ...**

➔ enrichment of **siderophile** elements (PGE's, Mo, W, Au, Cu, ...) in the metal phase during **core formation**, i.e. **strong depletion** in the silicate Earth

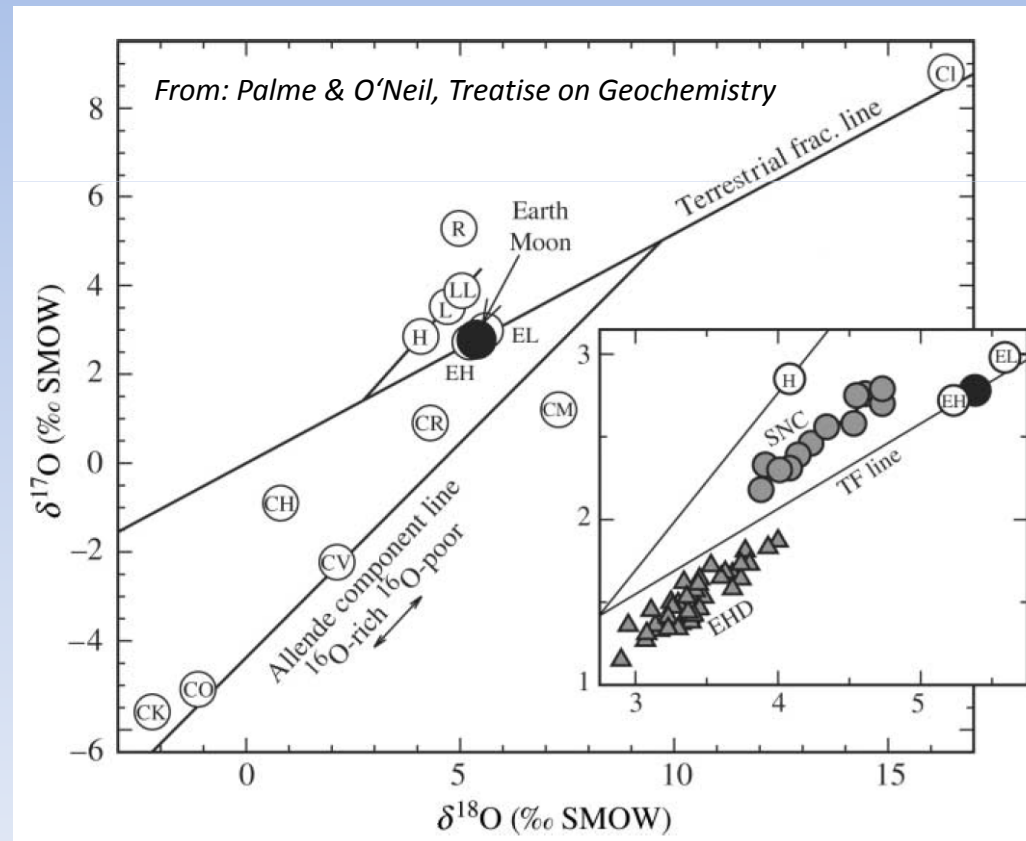
... and by the **(re-)addition of siderophile elements** to the silicate Earth **after** core formation:

➔ „**late veneer**“ (or „**late-heavy bombardment**“) to establish a siderophile element inventory in the silicate Earth higher than expected from silicate – metal partitioning

Brief excursion: Composition of the (bulk) Earth

Arguments against a carbonaceous chondritic bulk Earth:

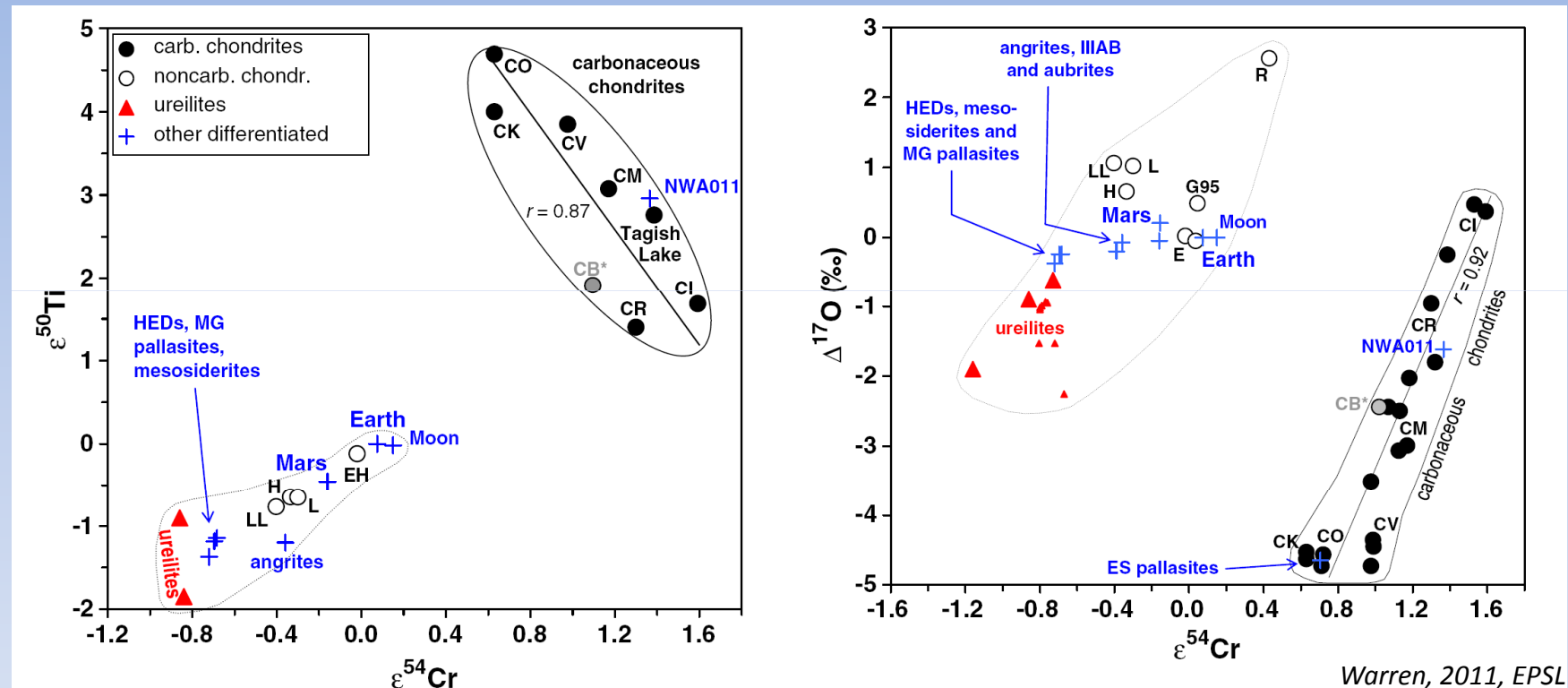
Oxygen isotope composition of different types of **chondrites** and the **Earth – Moon** system



Oxygen **stable isotope** compositions are **not consistent** with a carbonaceous chondritic Earth but suggest other chondritic components (enstatite chondrites) played a role

Brief excursion: Composition of the (bulk) Earth

Arguments against a carbonaceous chondritic bulk Earth:



Several other **stable isotope** compositions are also **not consistent** with a carbonaceous chondritic Earth and also suggest **non-carbonaceous components**