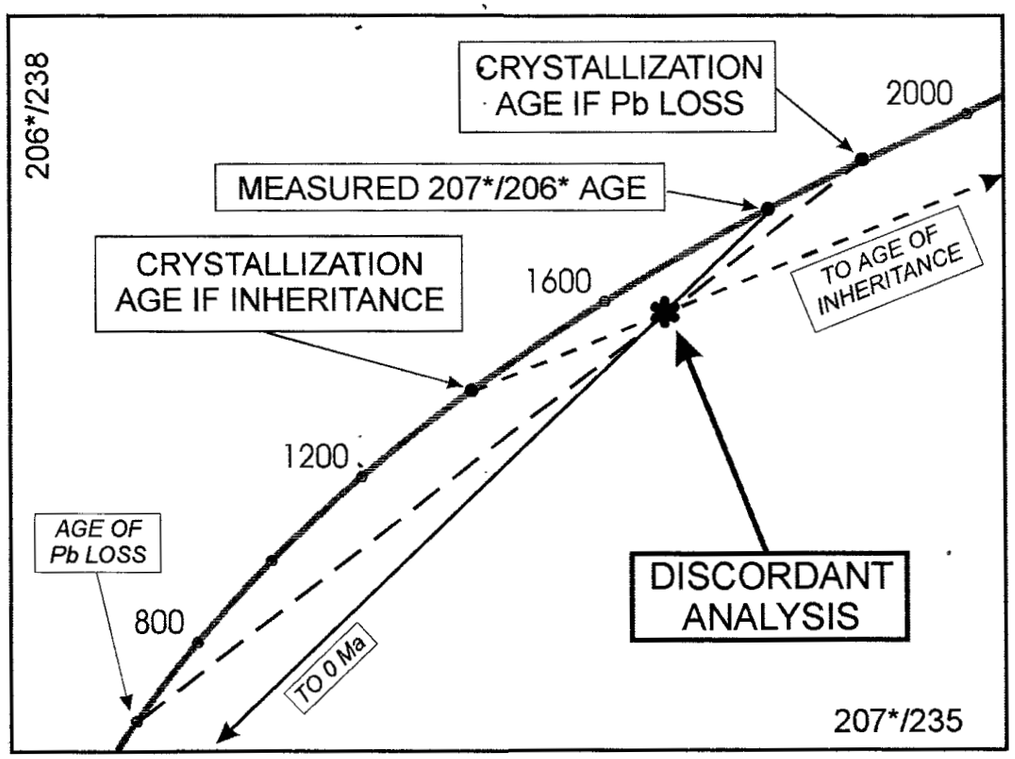
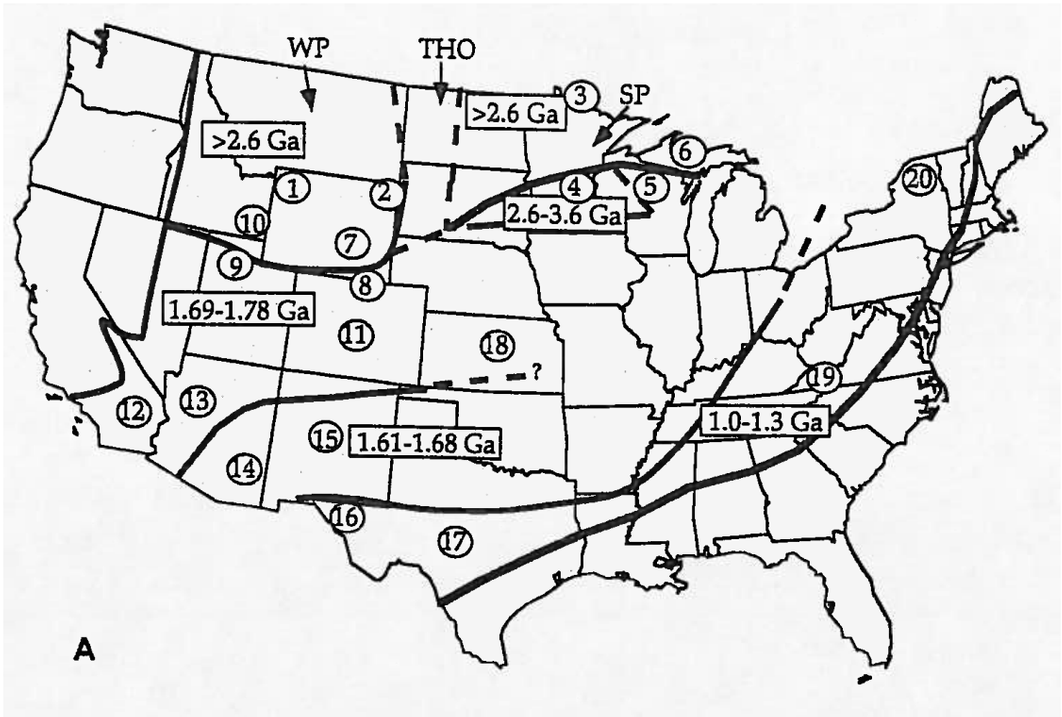


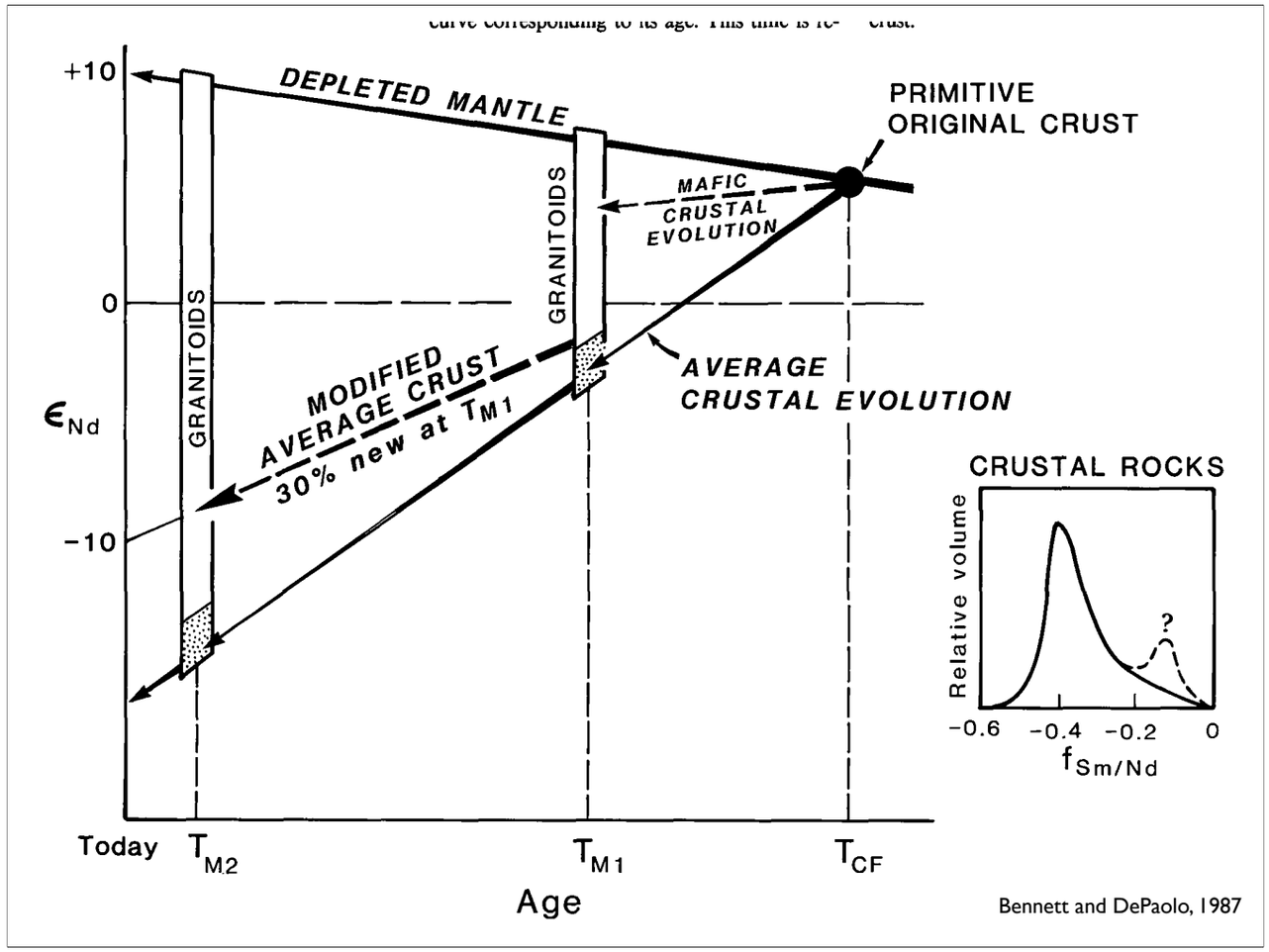
Fig. 3. Schematic diagram showing the relationship between measured 207*/206* age and actual crystallization age for a hypothetical zircon grain that is discordant due to either Pb loss or inheritance of older radiogenic components. This example is 14 percent discordant, as measured along the 207*/206* line. All grains for which ages are interpreted in this study are less than 17 percent discordant, and the average discordance for these grains is 1.8 percent.

Gehrels and Dickinson, Am J Sci. 1995

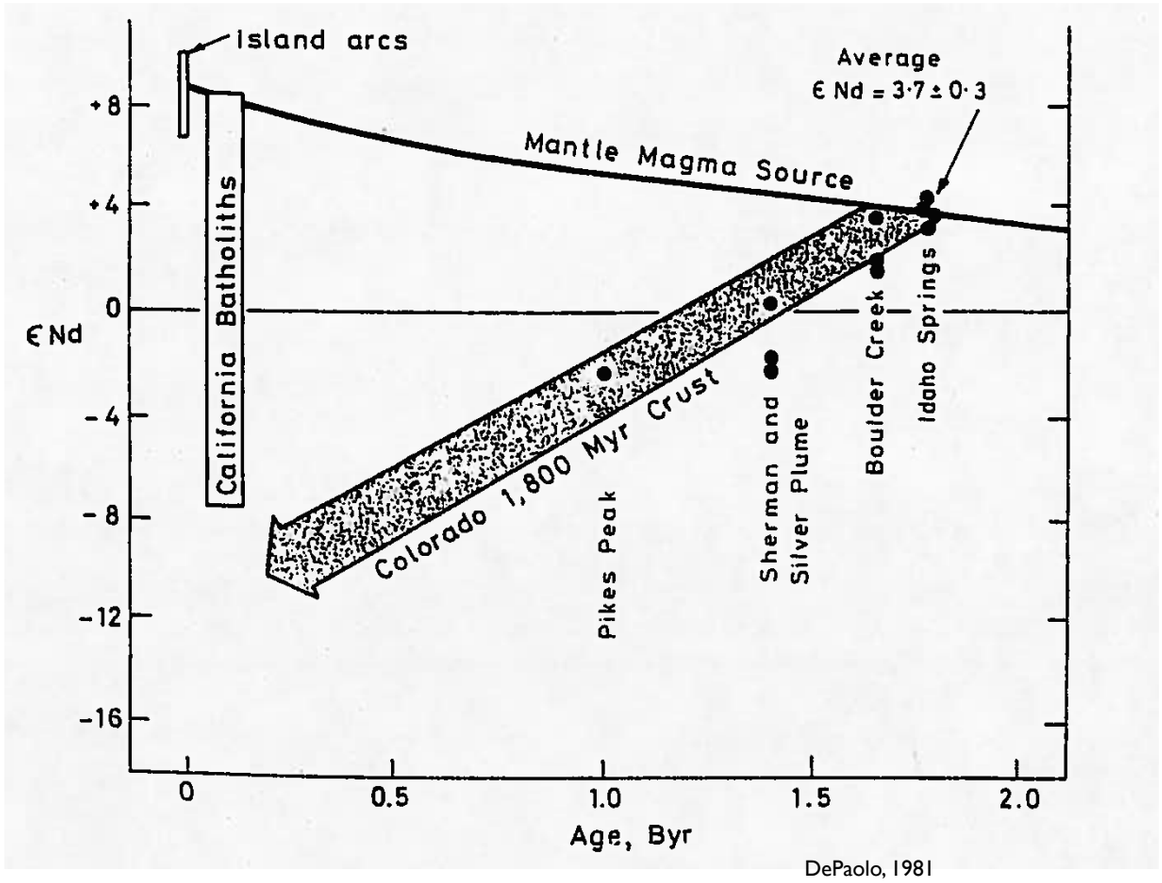
Crystalization ages



Reed et al, DNAG



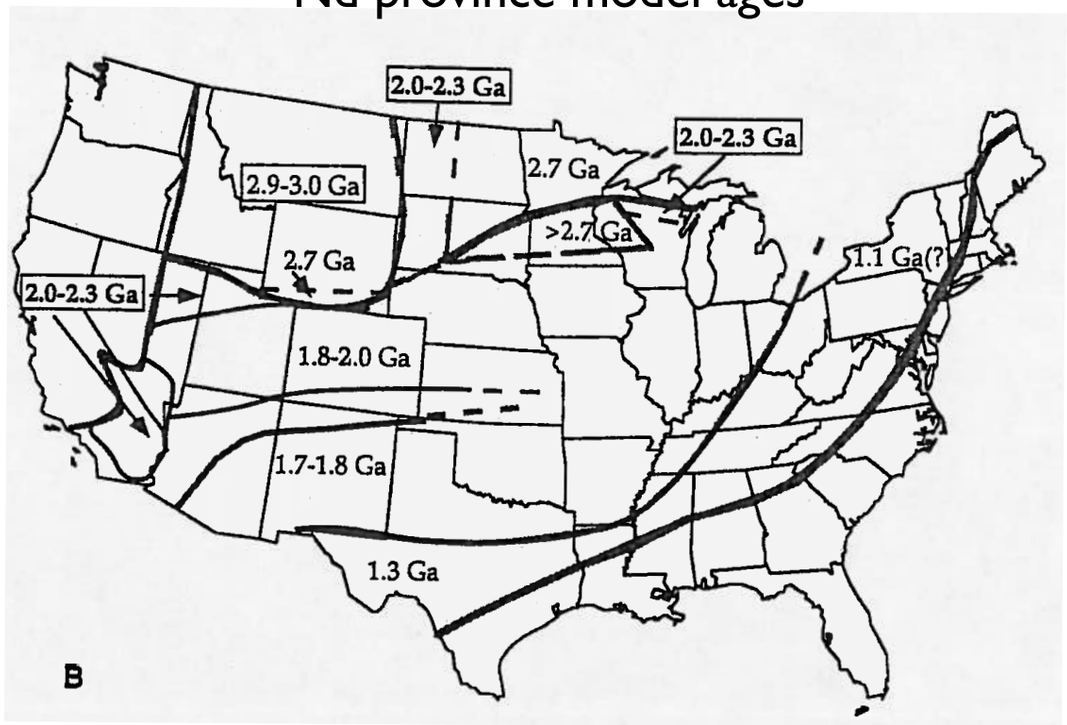
Sm stays in mantle, so crust poor in 147 Sm, so production of 143 Nd lower in crust than mantle (note that ENd is time-dependent).



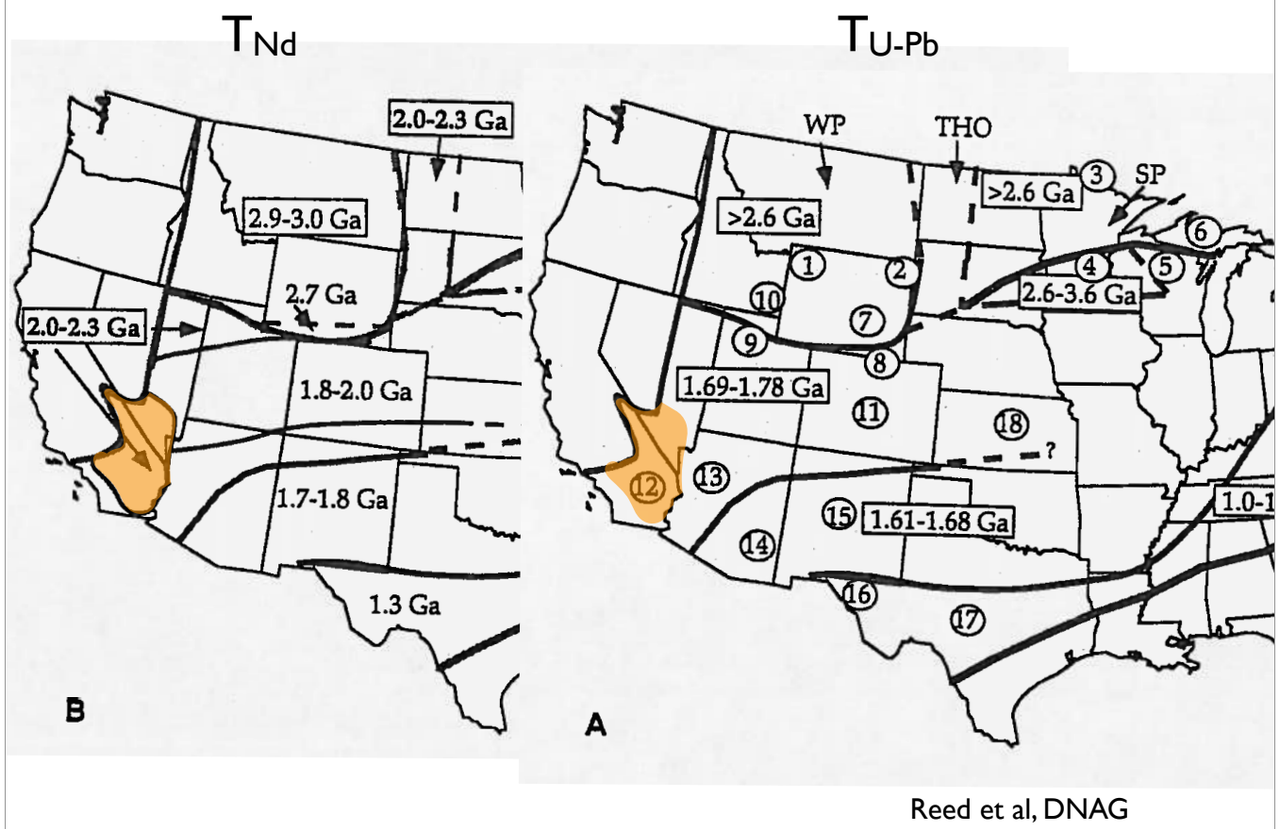
DePaolo, 1981

Simple diagram showing how ENd would still follow same path if reworked by igneous processes within the lithosphere.

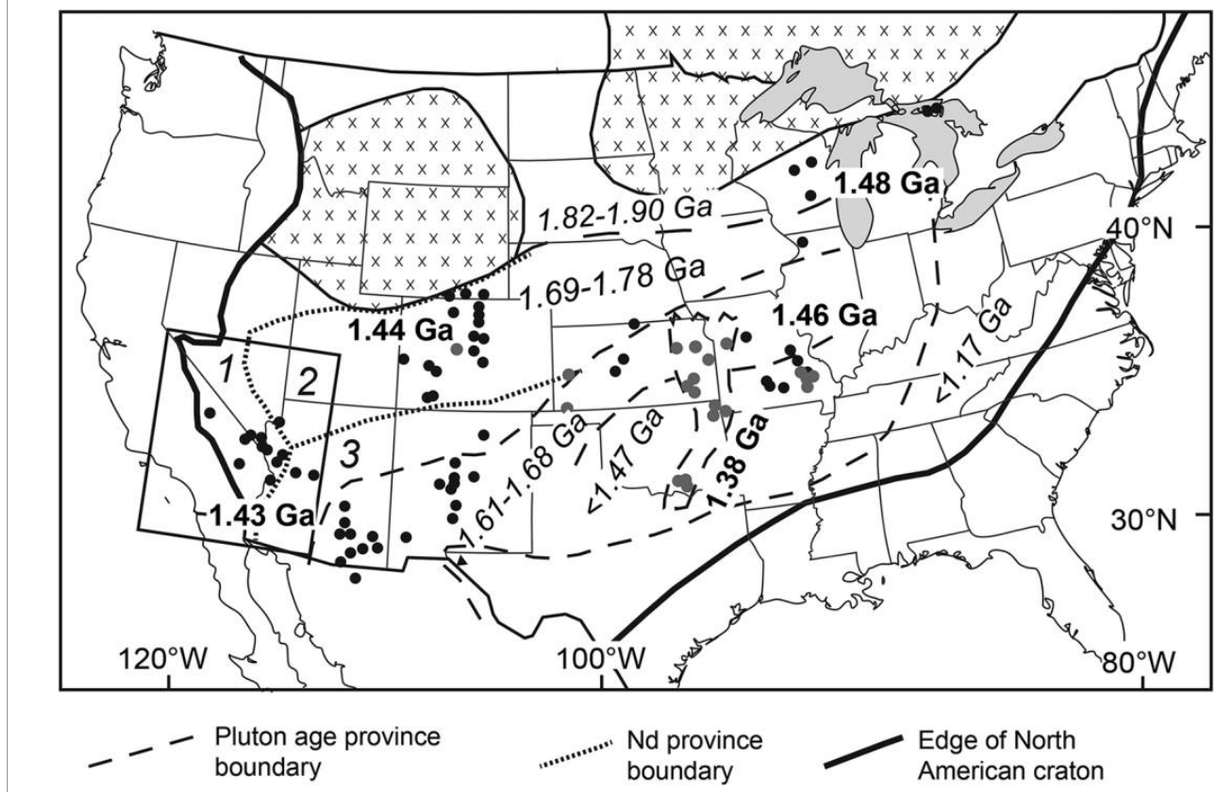
Nd province model ages



Reed et al, DNAG

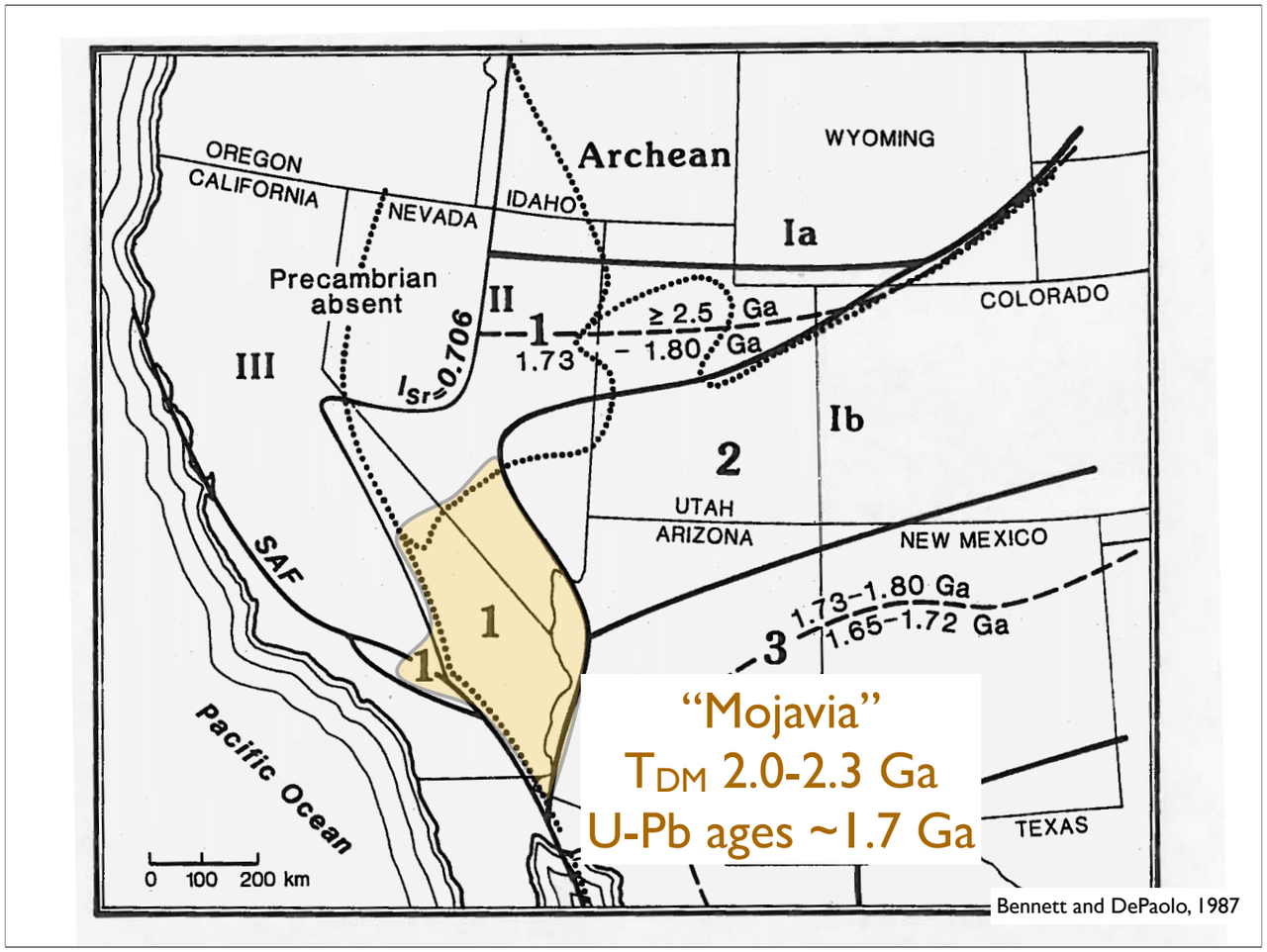


Reed et al, DNAG

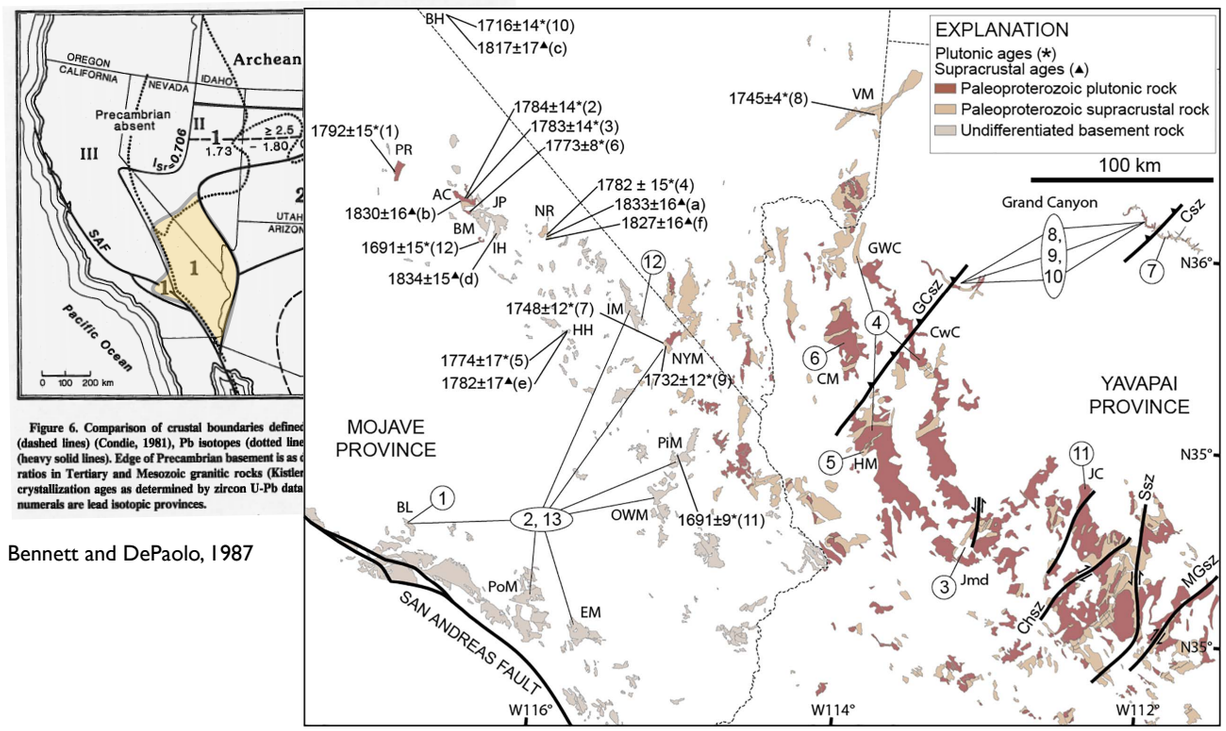


Almeida et al, *J. Geol*., 2016

Dots here are “anorogenic” granites, 1.31–1.41 in gray, 1.41–1.49 in black. Note the numbering of provinces (1 is Mojavia as defined earlier, 2 is Yavapai, 3 is Mazatzal



dashed lines crystalization ages, dotted lines lead isotopes, Nd isotopes solid lines
Note region 1 to north has been discredited as having the same characteristics as Mojavia (Nelson et al., Geosphere, 2011) and they suggest edge of Archean is actually near Idaho line and difference between regions 1 and 2 is amount of sediment shed onto paleoproterozoic.



Bennett and DePaolo, 1987

Holland et al., Precamb. Res., 2018

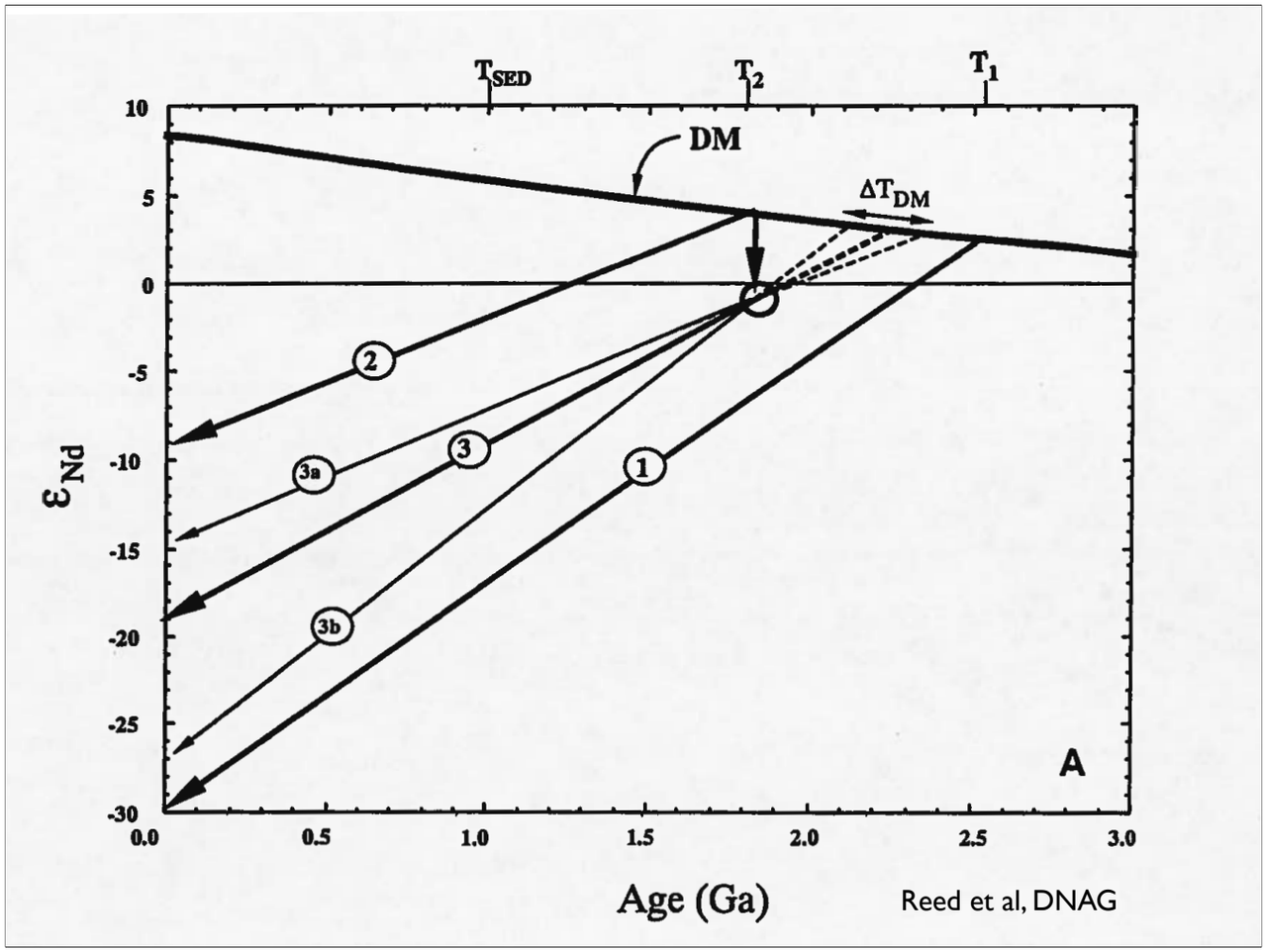
"Mojavia"

T_{DM} 2.0-2.3 Ga

U-Pb ages ~1.7 Ga

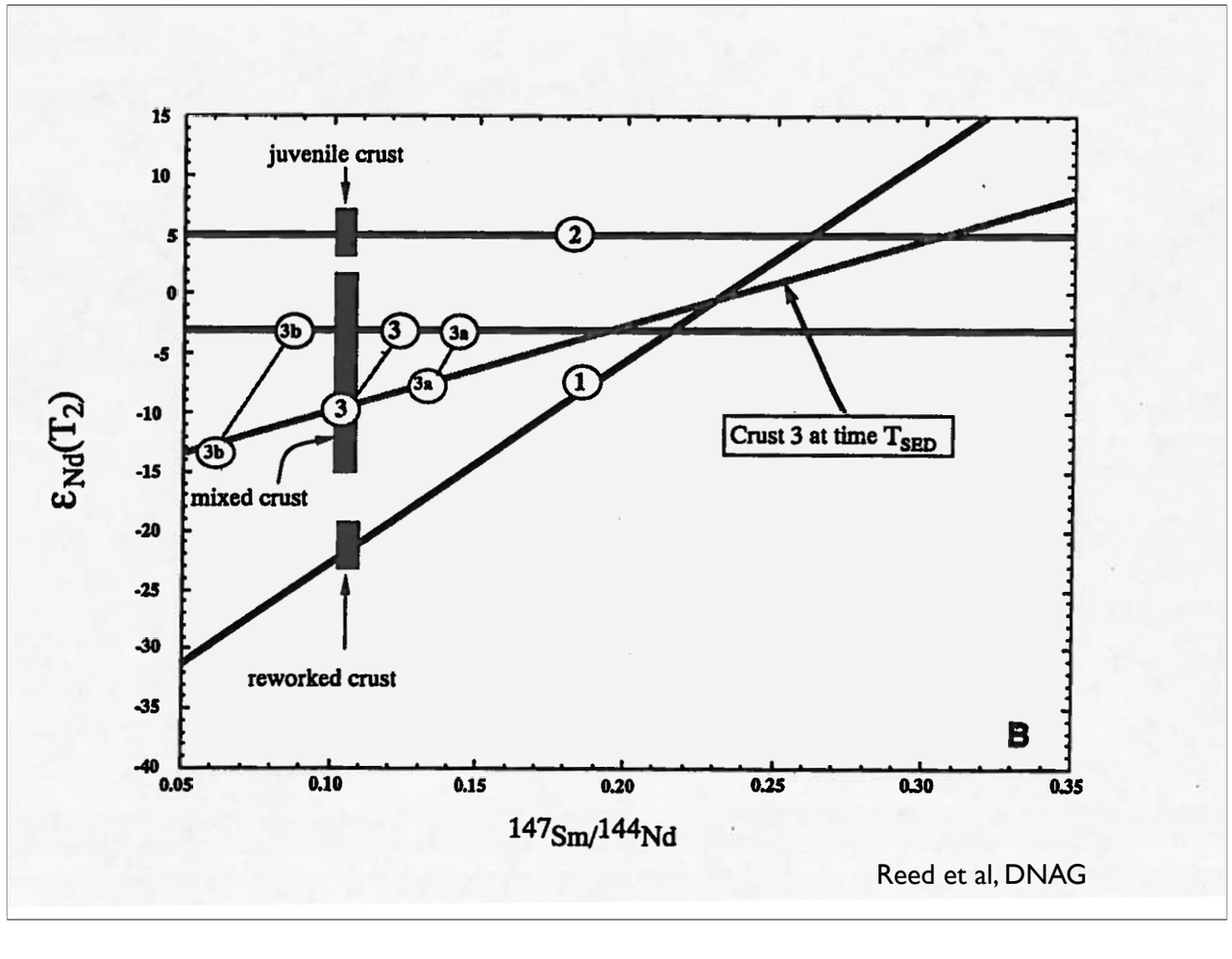
Note range of plutonic ages (Starred) reported from Mojave

Garnet gneisses of New York Mtns.



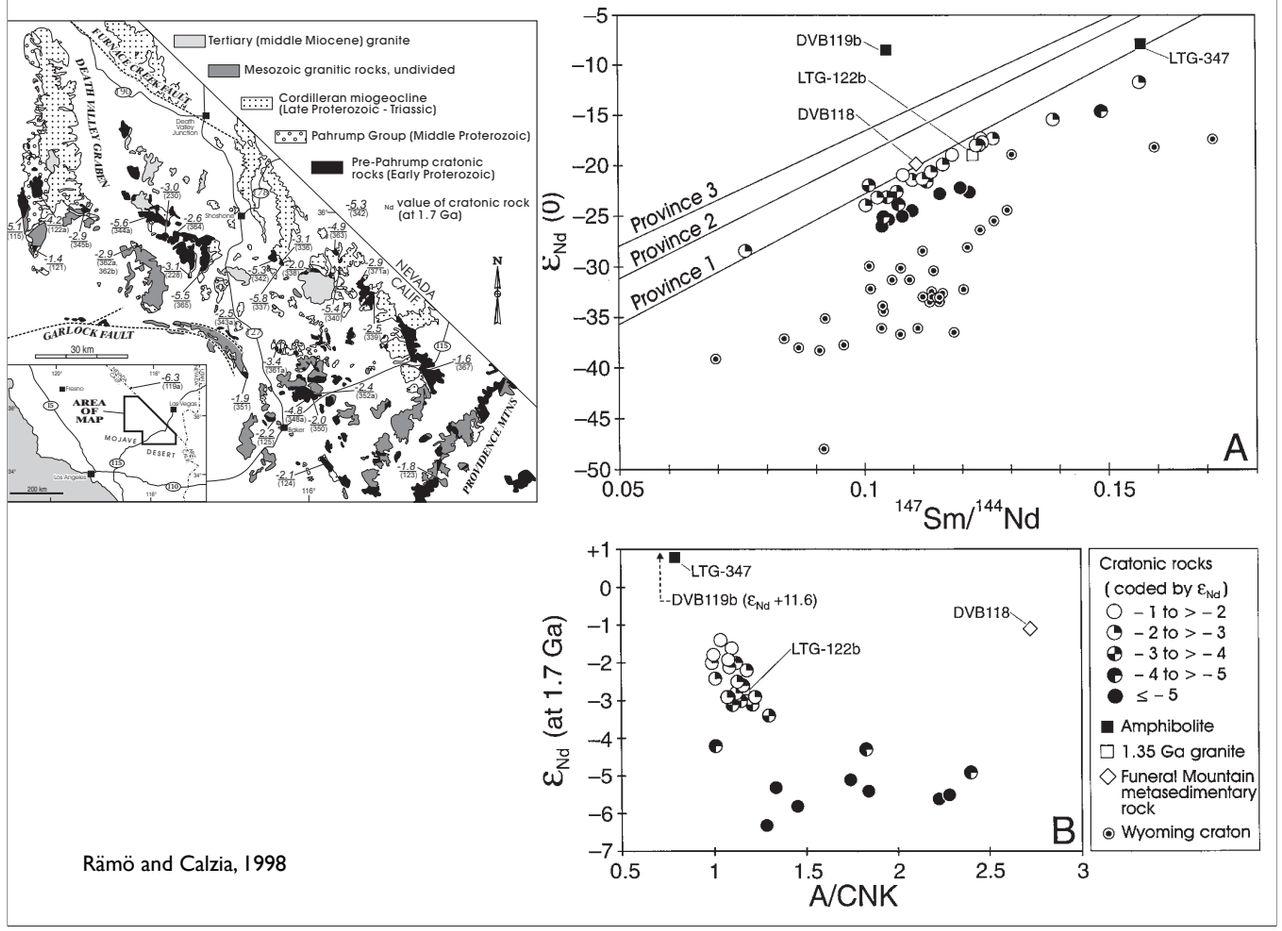
Reed et al, DNAG

Crusts 1 and 2 are juvenile at T1 and T2. Crust 3 is assumed mix of 1 & 2 at time T2. TSED for next plot. TDM (model ages for crust 3) meaningless. 3a and 3b are for different initial Sm/Nd ratios. When these all back project together you get the time of creation (though can be from mixing).



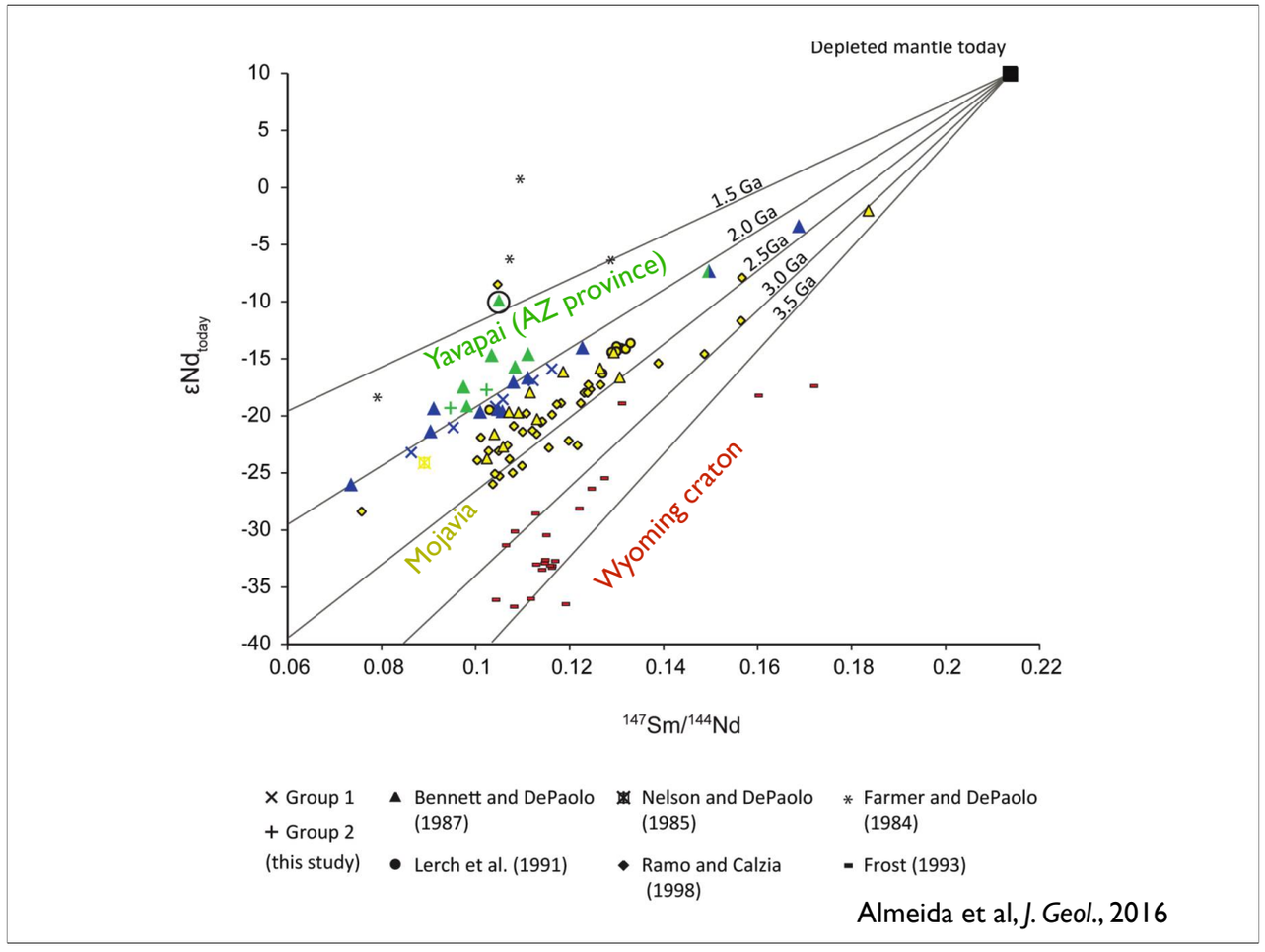
Reed et al, DNAG

Approach proposed to separate mixing from juvenile crust. In this plot, juvenile crust on line 2, reworked old crust on 1, mix in between. Line 3 would be a uniform mix that then evolves so at TSed you get a tilted line for sediments.



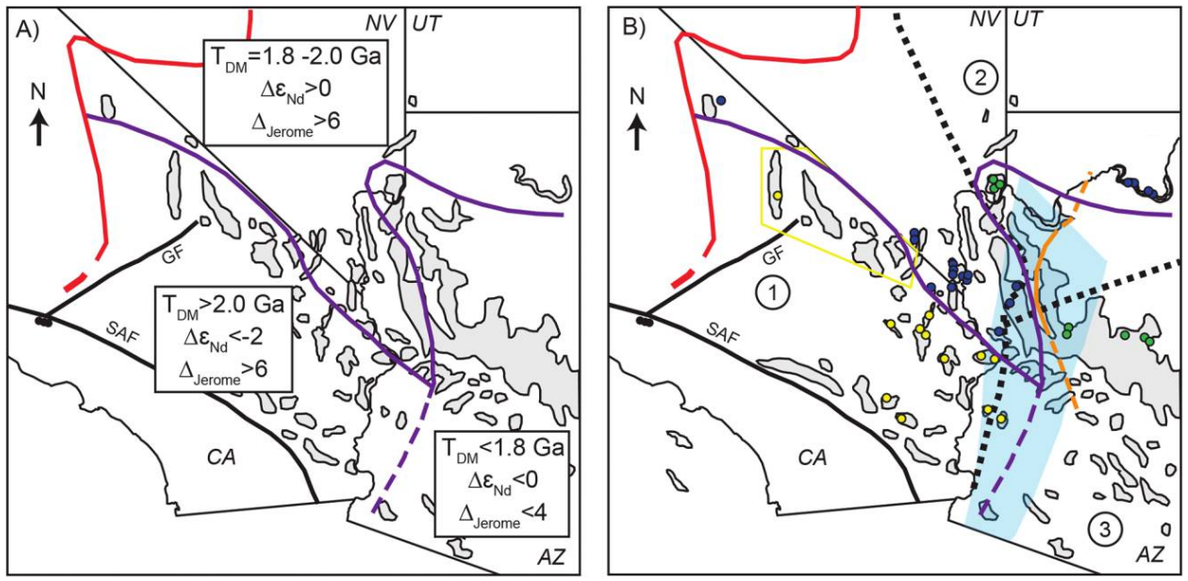
Rämö and Calzia, 1998

A: Nd isotopic compositions of cratonic rocks analyzed in this study. Data on 36 samples from Archean Wyoming craton (Bennett and DePaolo, 1987; Koesterer et al., 1987; Wooden and Mueller, 1988; Geist et al., 1989; Frost, 1993) and best-fit lines of data on the three crustal Nd provinces of southwestern United States (see Bennett and DePaolo, 1987; Farmer and Ball, 1997) are shown for reference [1 is Mojavia]. B: ε_{Nd} (at 1.7 Ga) vs. A/CNK diagram; A/CNK is molecular $Al_2O_3/(CaO + Na_2O + K_2O)$ (data in Table A; see footnote 1).
These Mojavia rocks extend the range of “Province 1” (Mojavia) to TDM of 2.6 Ga and the range of ENd indicates a non-uniform source (i.e., this was no juvenile 2.3 Ga crust).



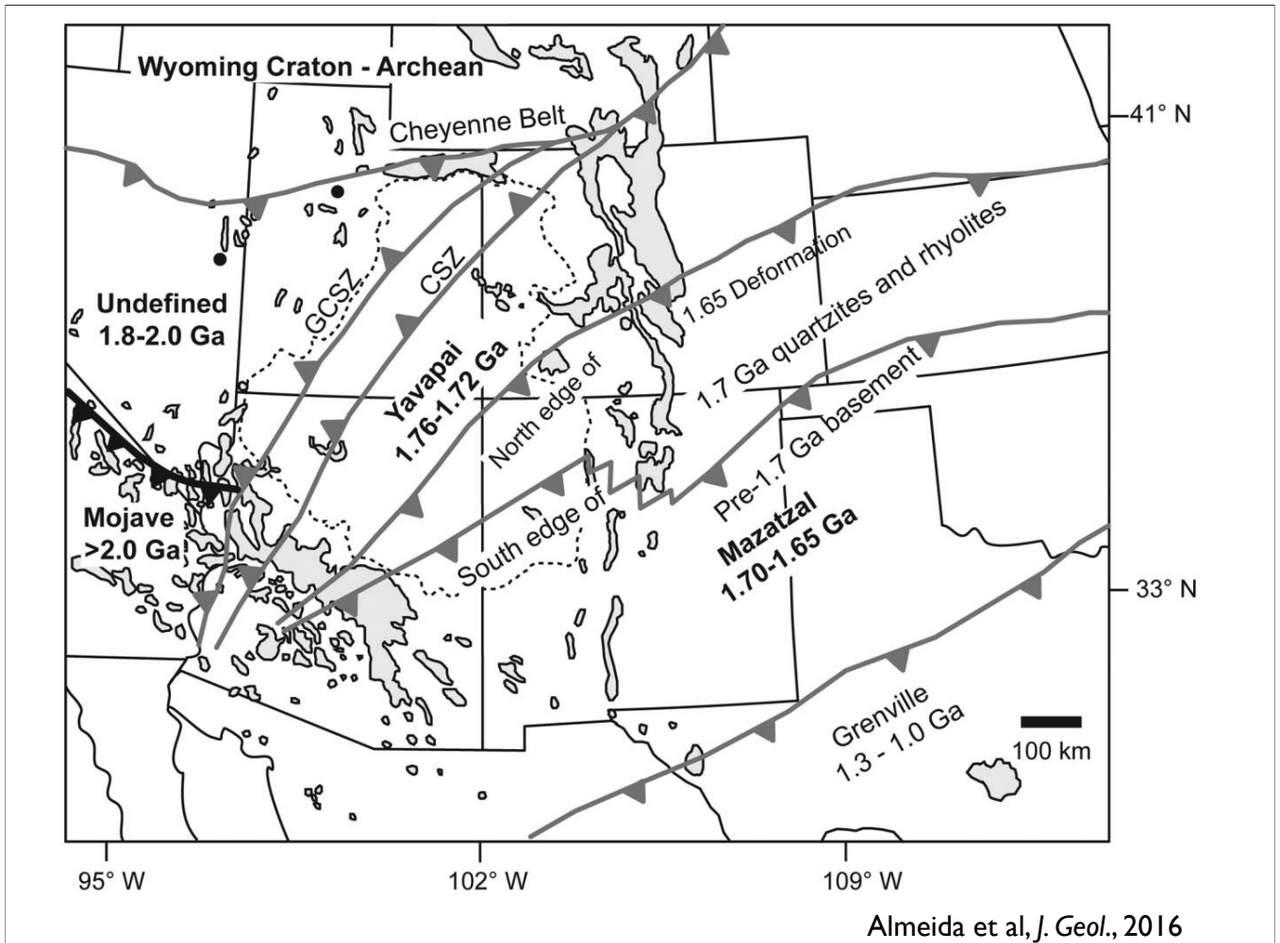
Almeida et al, *J. Geol.*, 2016

Note this is modern eNd. Blue is proposed intermediate terrain

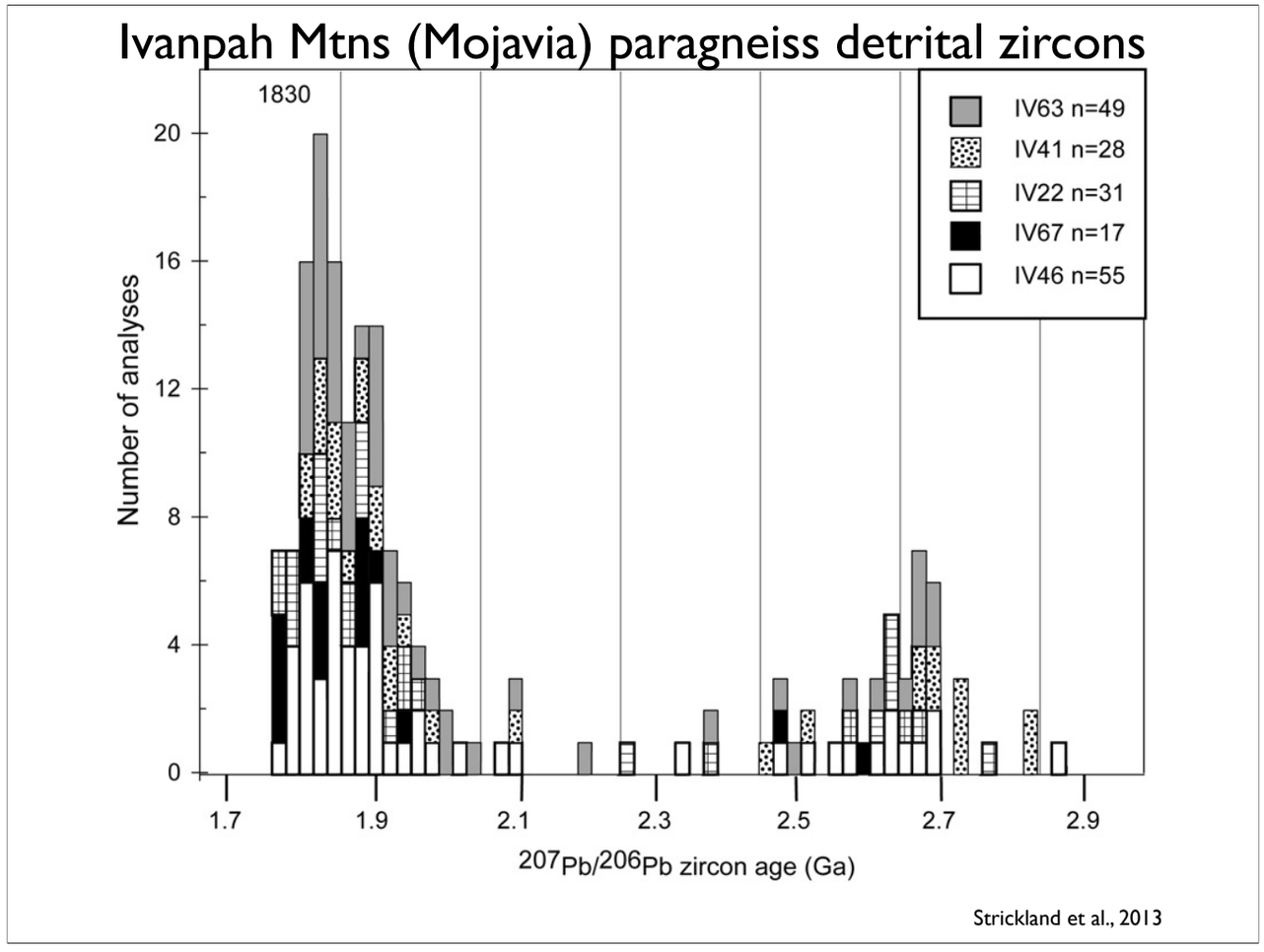


Almeida et al, *J. Geol.*, 2016

Left is Almeida's new interpretation, right has the older lines for comparison. In particular, they interpret the northern boundary of Mojavia as a subduction zone. ΔJerome, which is expressed as 100 times the difference between the measured 207Pb/ 204Pb and a modeled 207Pb/204Pb value that is calculated on the basis of the measured value of 206Pb/204Pb and the 1700 Ma isochron that passes through the Pb isotopic values of galenas from a mine in Jerome, Arizona

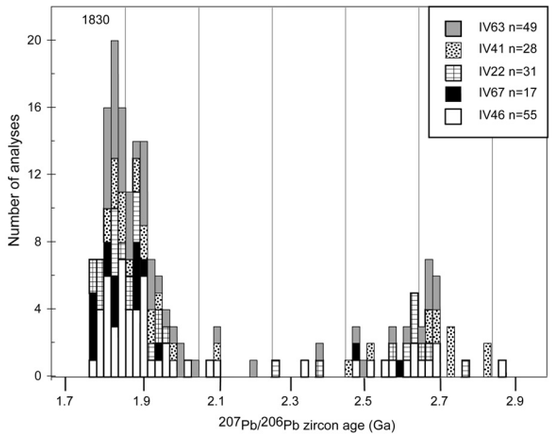


Almeida et al, *J. Geol.*, 2016

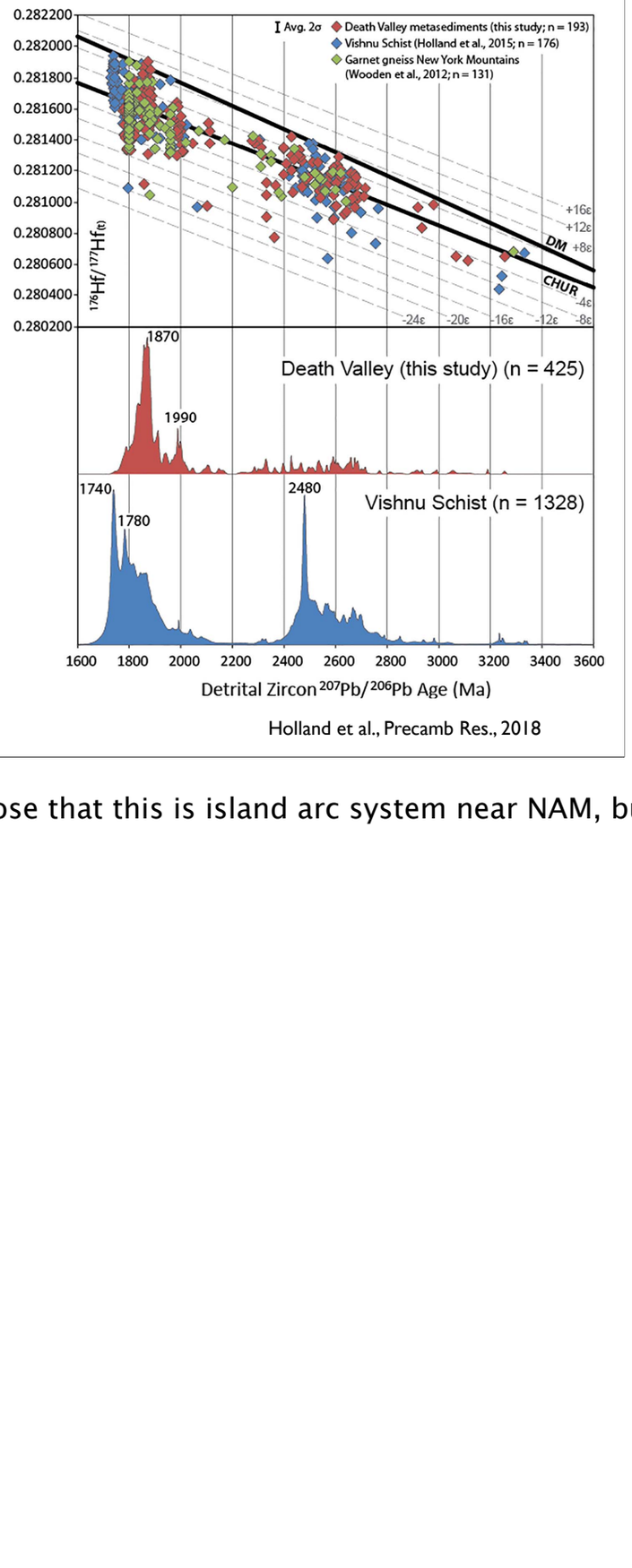


These authors think this looks a lot like NAM zircon populations, so propose that this is island arc system near NAM, but note that others argue for AUS for stuff to east.

Ivanpah Mtns (Mojavia) paragneiss detrital zircons



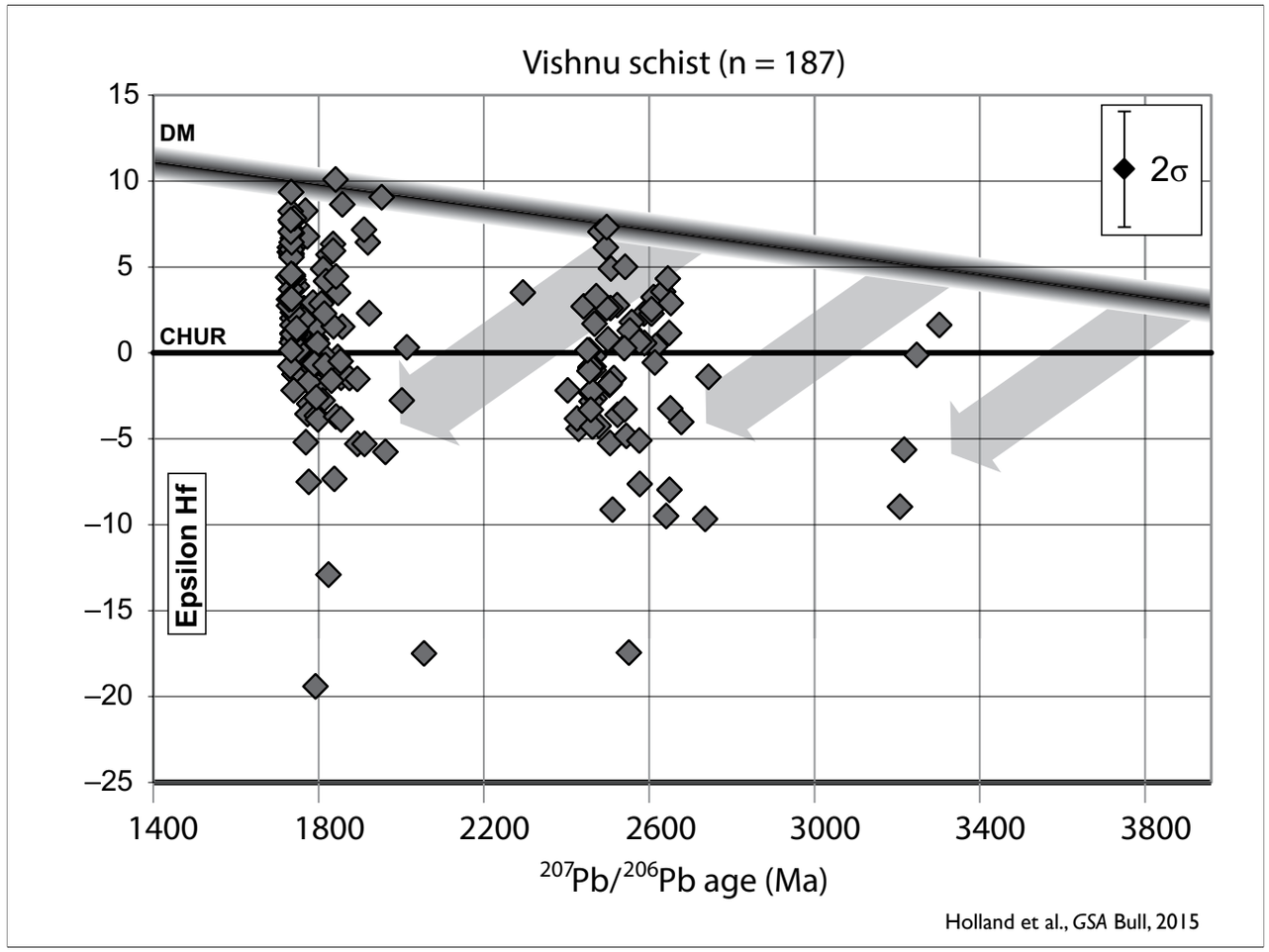
Strickland et al., 2013



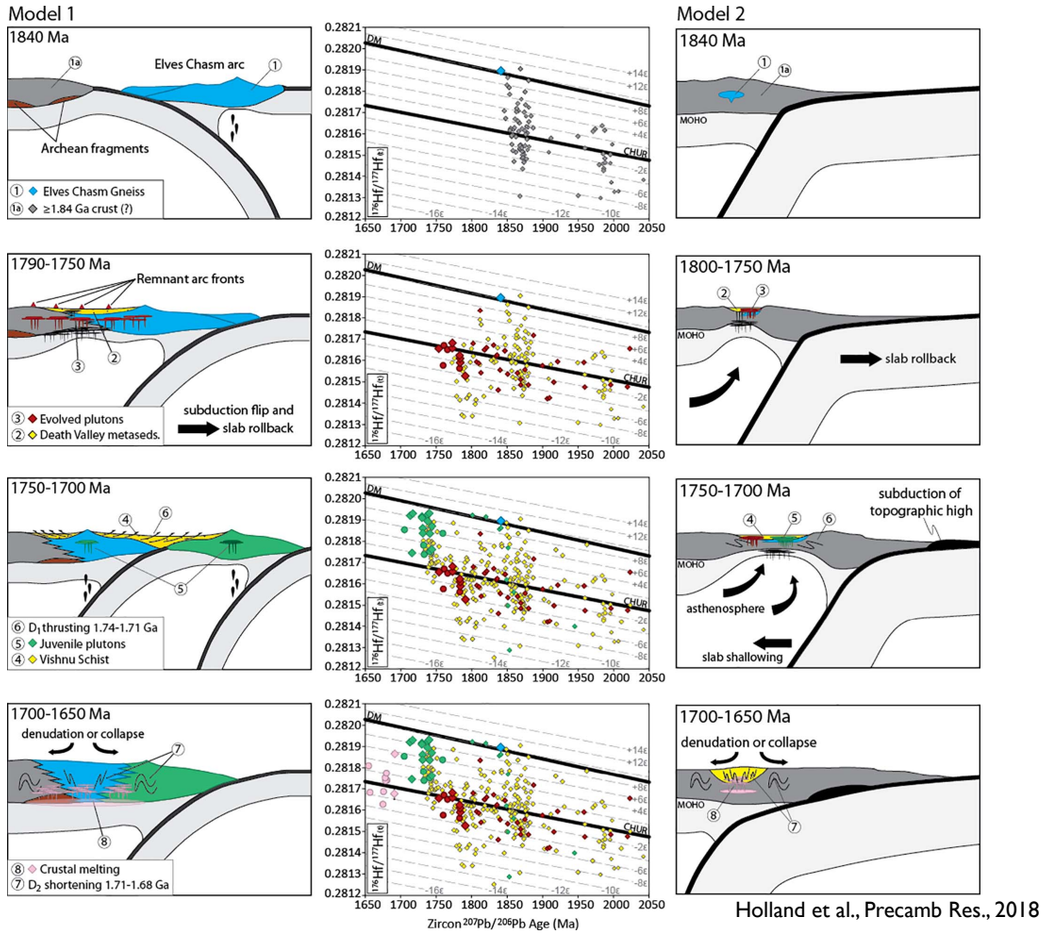
Holland et al., Precamb Res., 2018

same as Vishnu Schist (Grand Canyon)?

These authors think this looks a lot like NAM zircon populations, so propose that this is island arc system near NAM, but note that others argue for AUS for stuff to east.



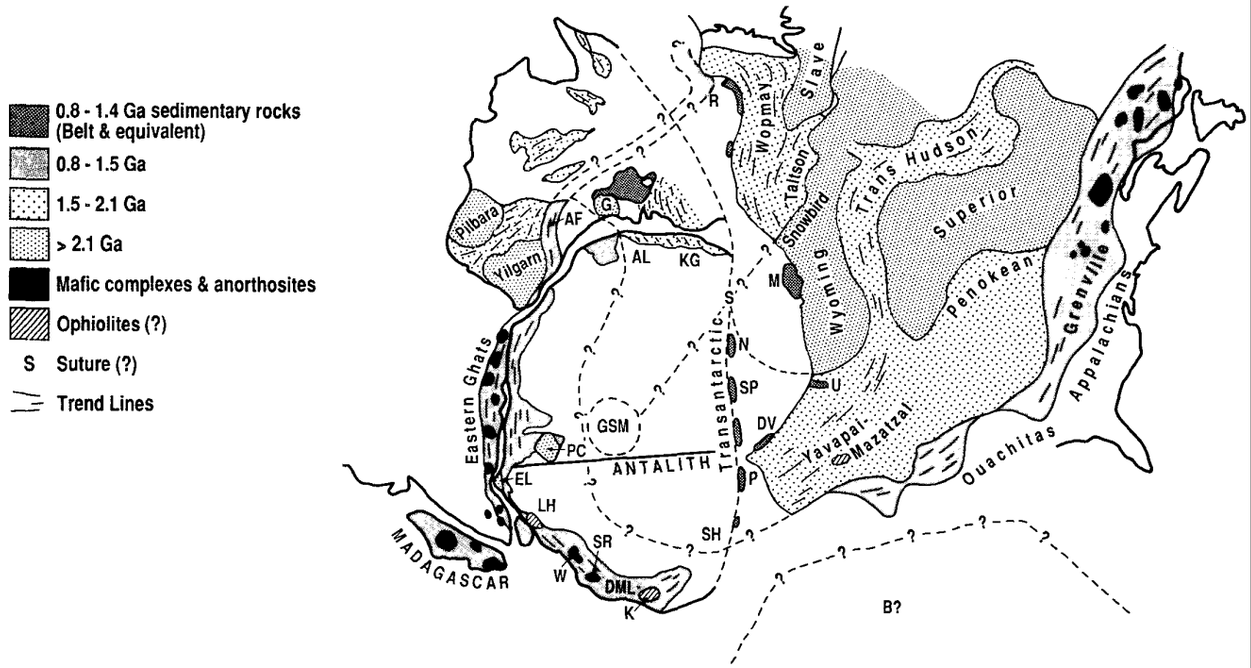
Vishnu Schist seems to have seds from pC crust with major additions c. 1.8, 2.5, 3.2 Ga. The range at the left edge looks a lot like what is seen in Mojavia, suggesting to these authors that Vishnu sourced to the (modern) west from Mojavia and something more ancient. This leads us to..what was there?



Holland et al., Precamb Res., 2018

Possible tectonic models for the Mojave province. Model 1 portrays terrane accretion of a juvenile 1.84 arc (Elves Chasm pluton) to Mojave ~1.8 Ga followed by accretion of the juvenile Yavapai province ~1.75–1.70 Ga. Model 2 portrays a single subduction system that evolves through slab roll back, back arc extension, and instigation of the Yavapai orogeny by arrival of an oceanic plateau into the subduction system. Diamonds represent data from this study and Holland et al. (2015), circles are data from Wooden et al. (2012).

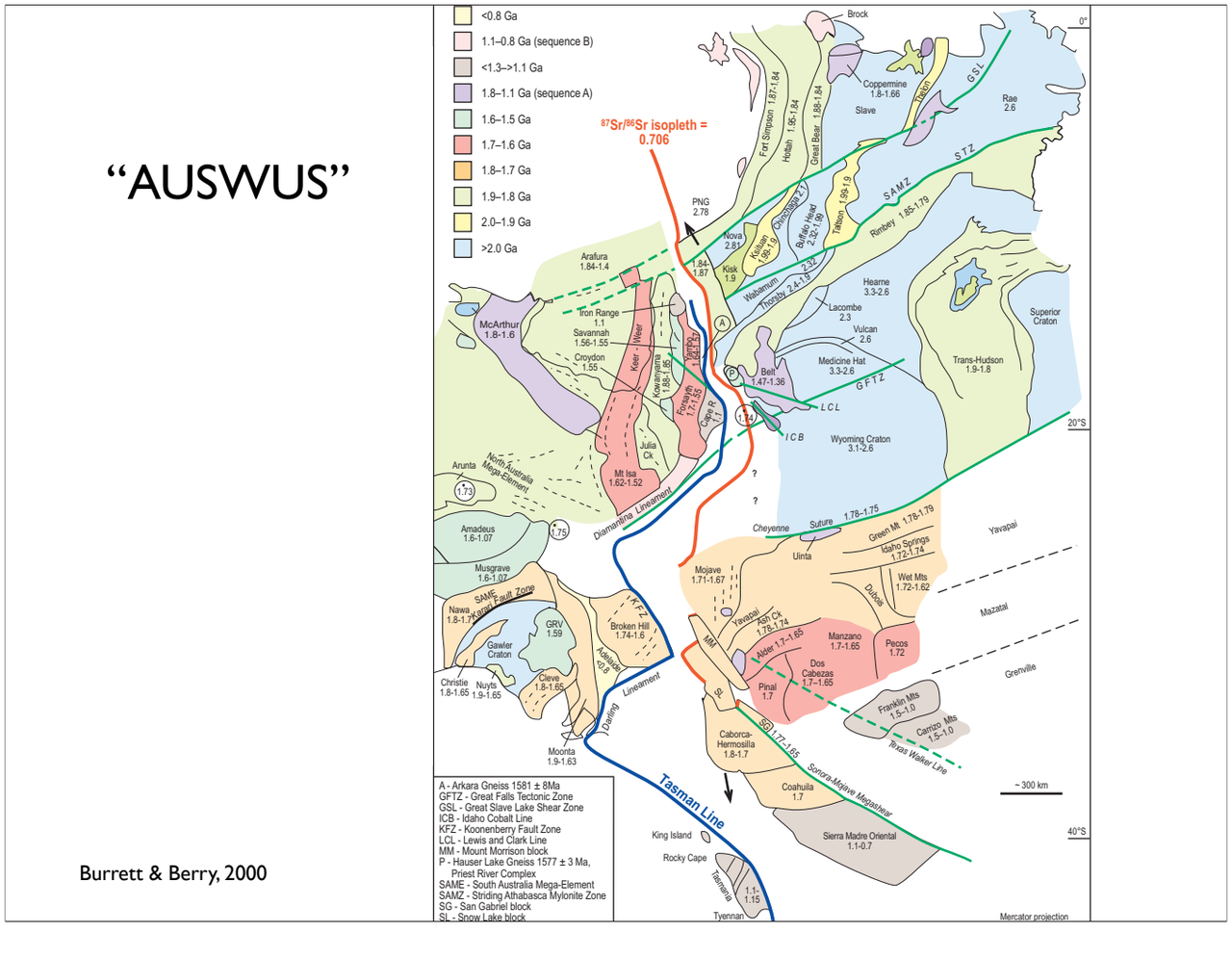
"SWEAT" hypothesis



Moores, 1991

SWEAT = SW US + East Antarctica

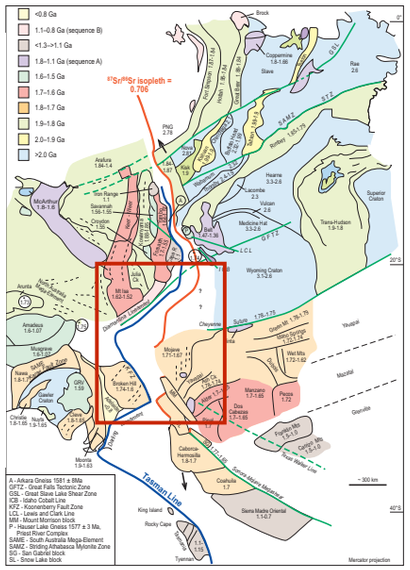
“AUSWUS”



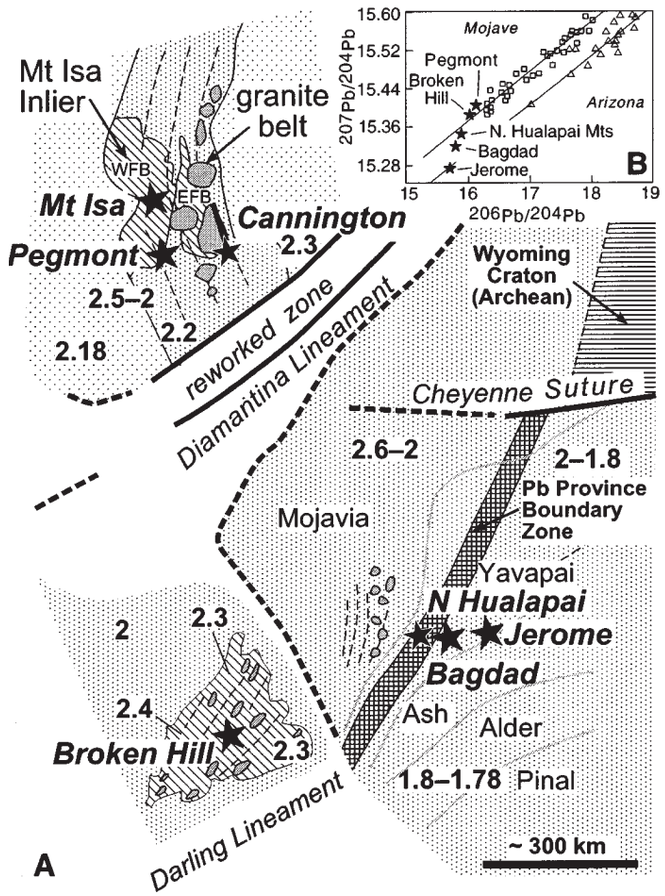
Burrett & Berry, 2000

Numbers are Nd model ages. Australia-WUS. more detailed map includes Grenville, so c. 1100 Ma

"AUSWUS"

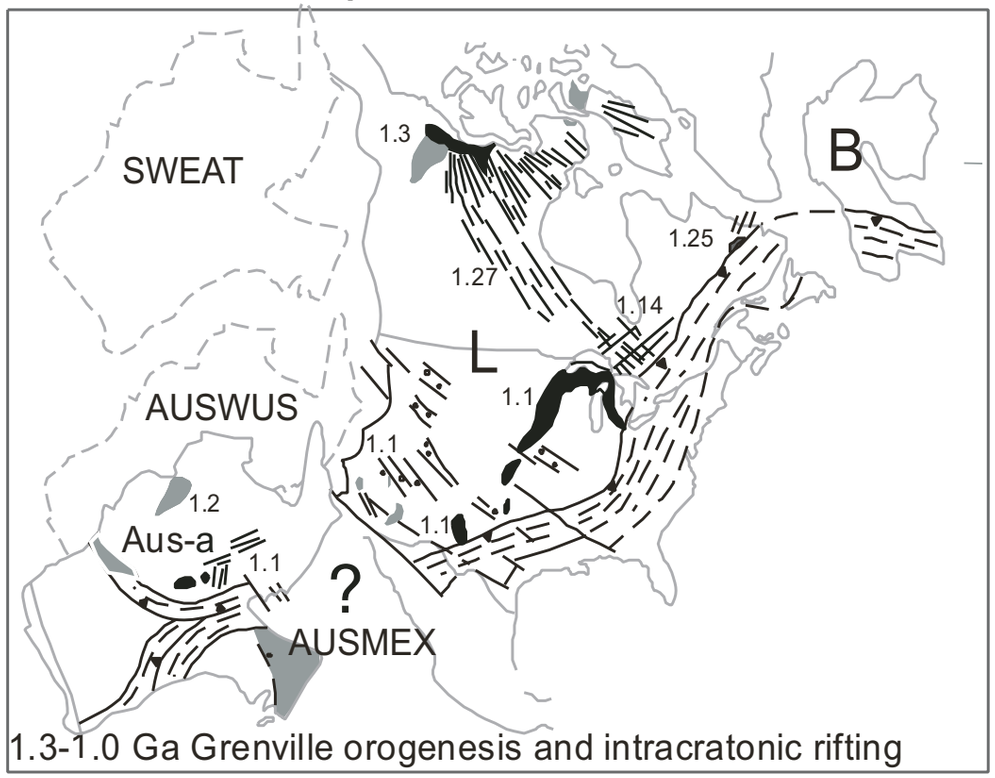


Burrett & Berry, 2000



Numbers are Nd model ages. Australia-WUS. more detailed map includes Grenville, so c. 1100 Ma

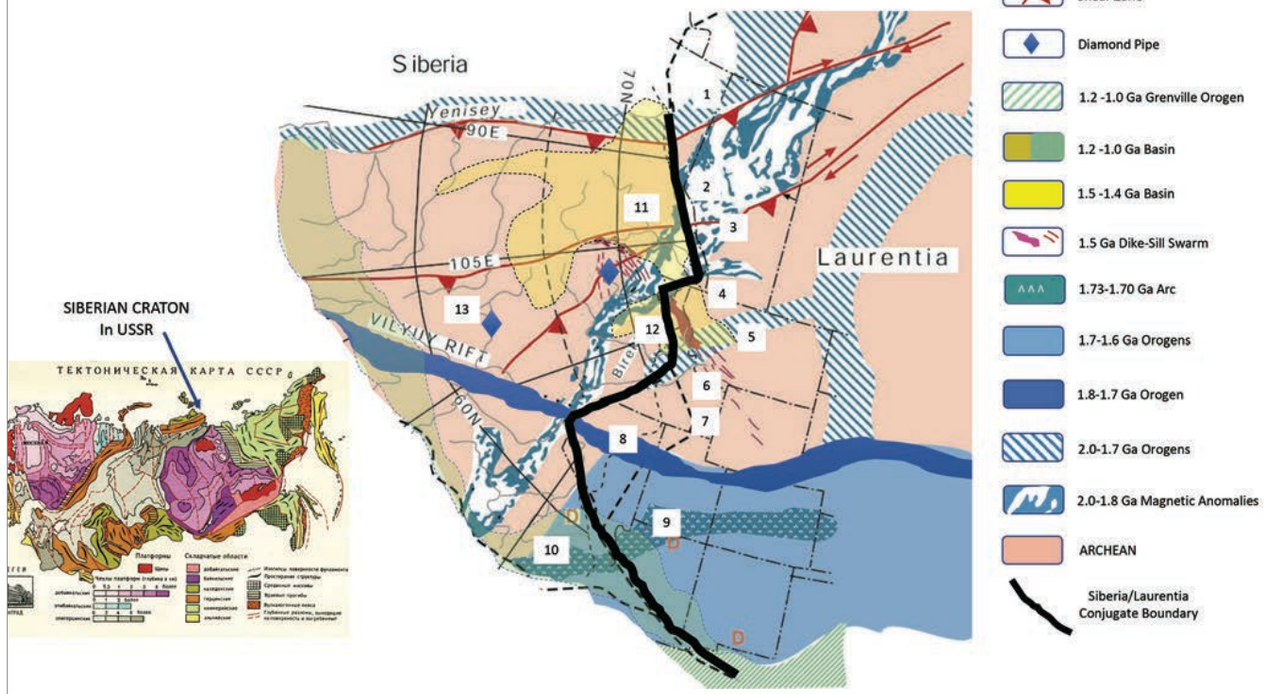
Various Australian positions…



Timmons et al., GSAB 2005

Numbers are Nd model ages. Australia-WUS

Siberia

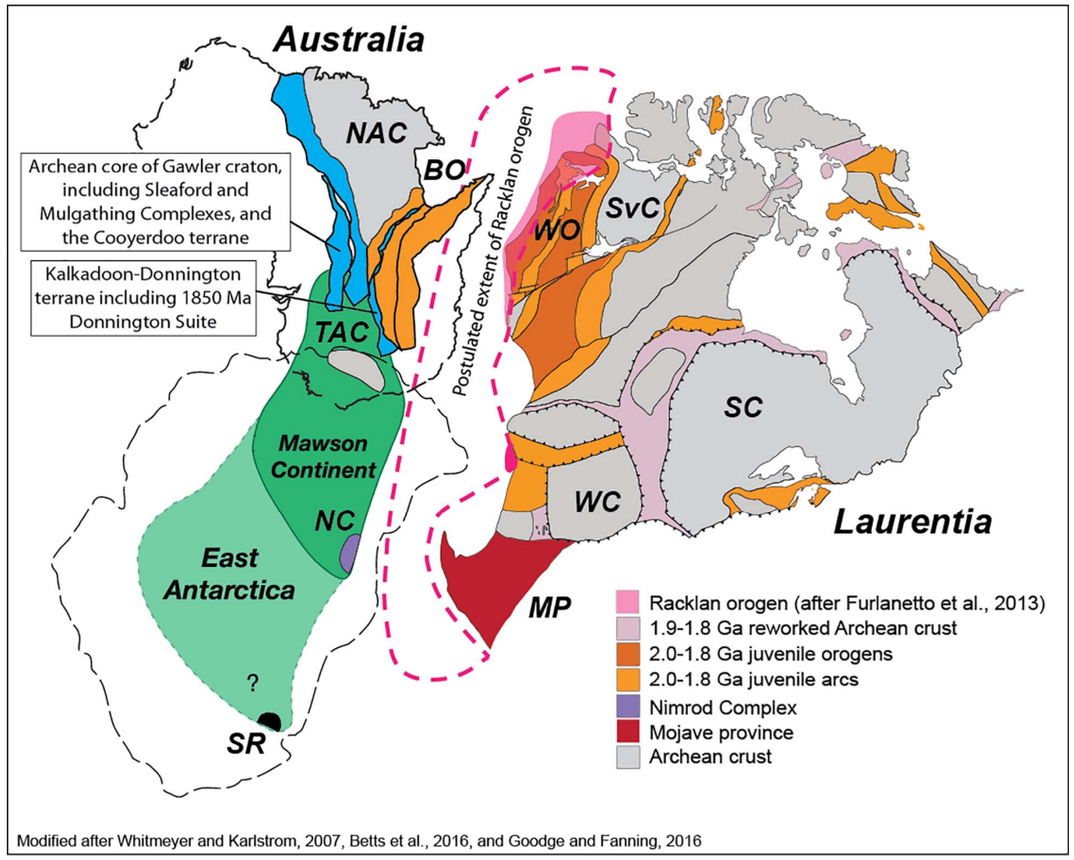


Sears, 2022

Sears still likes this in 2022 but has to invoke a quadrupole field to get around paleomag…

Modified SWEAT

(in Nuna supercontinent c.1700 Ma)



Holland et al., Precamb Res, 2018

Their caption: Fig. 11. Possible plate reconstruction of Australia, Antarctica (Mawson), and Laurentia in Nuna from 1.8 to 1.6 Ga. Australian cratons are shown as depicted in Betts et al., 2016. BO=Barramundi Orogen, MP=Mojave province, NC=Nimrod Complex, NAC=North Australian Craton, SR=Shackleton Range, SvC=Slave Craton, SC=Superior Craton, TA = Terre Adélie Craton, WO = Wopmay Orogen, WC = Wyoming Craton.