Sawtooth Forum and Lecture Series Audience Packet:

‘What Lies Beneath: How the Idaho Batholith Influenced the Yellowstone-Snake River Plain Supervolcanoes’

Figure 1: Granite from the Idaho Batholith (PC William Mullins)

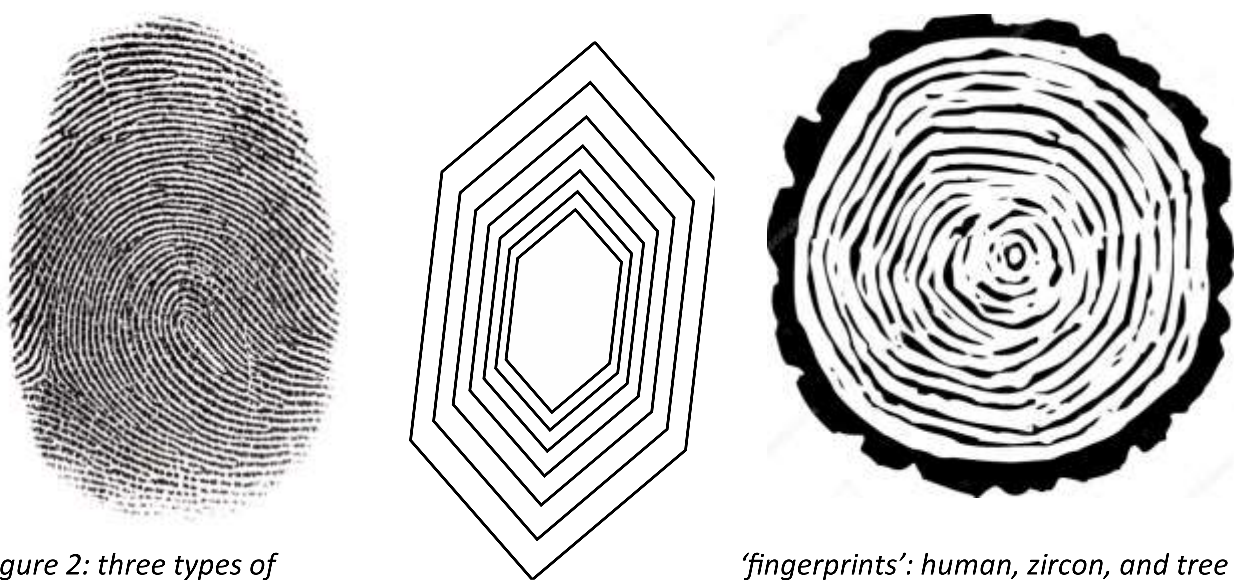


Figure 2: three types of ‘fingerprints’: human, zircon, and tree

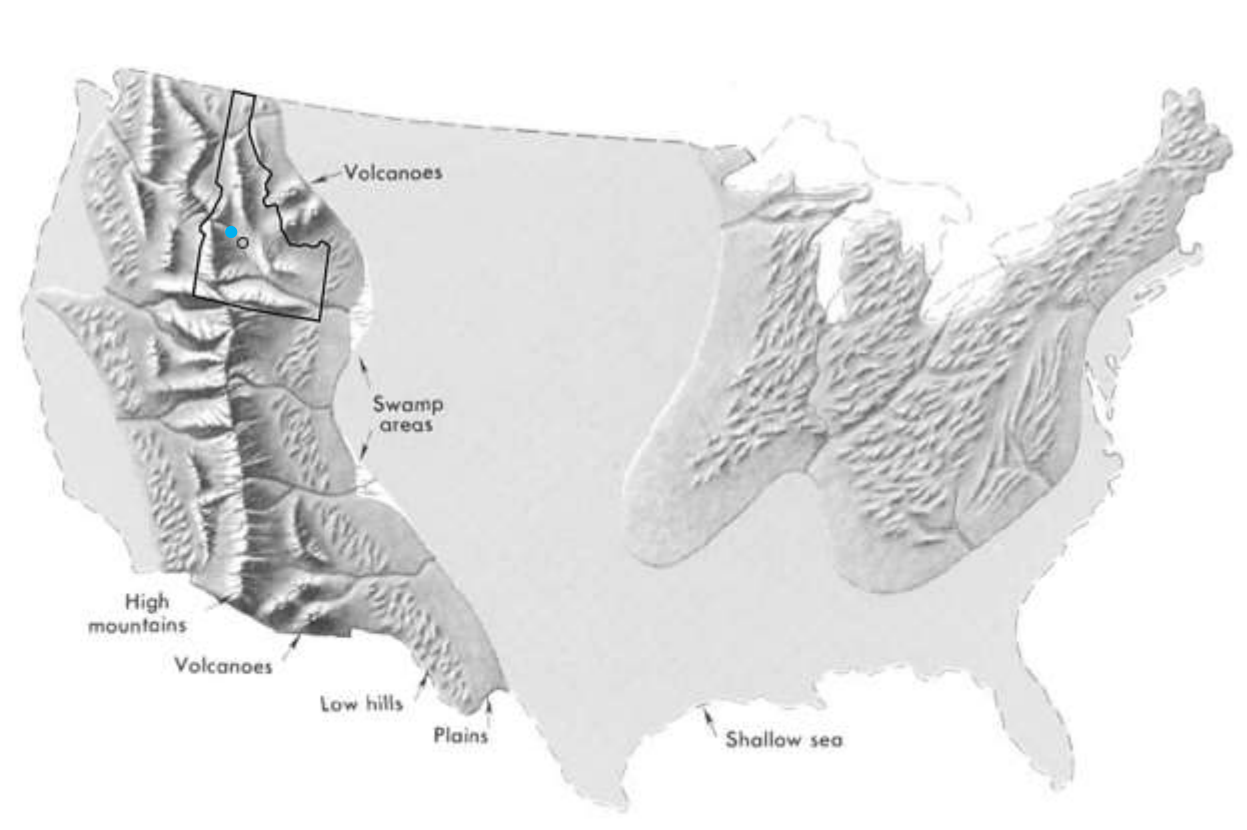


Figure 3: Map of U.S. during Late Cretaceous time, showing Idaho (black outline) and location of Stanley (blue dot). Adapted from https://www.usgs.gov/media/images/map-united-states-late-cretaceous-time

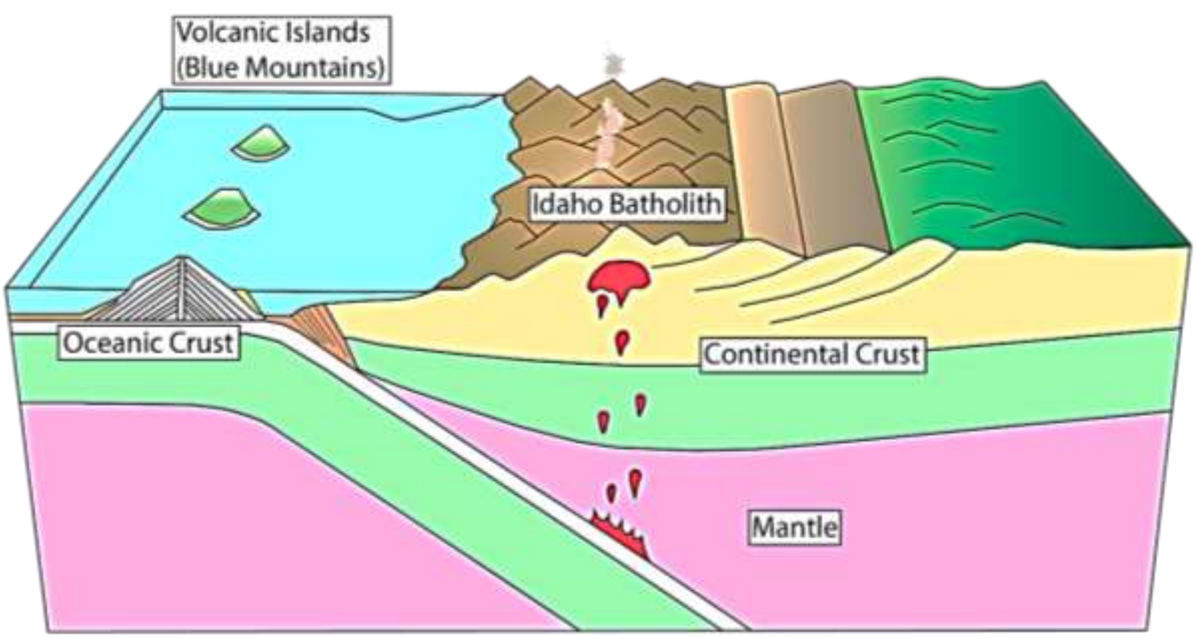


Figure 4: Cross section showing formation of Idaho Batholith, adapted from Idaho Museum.org overview of northwest geology (https://www.idahomuseum.org/wp-content/uploads/2014/01/Global-Overview.pdf)

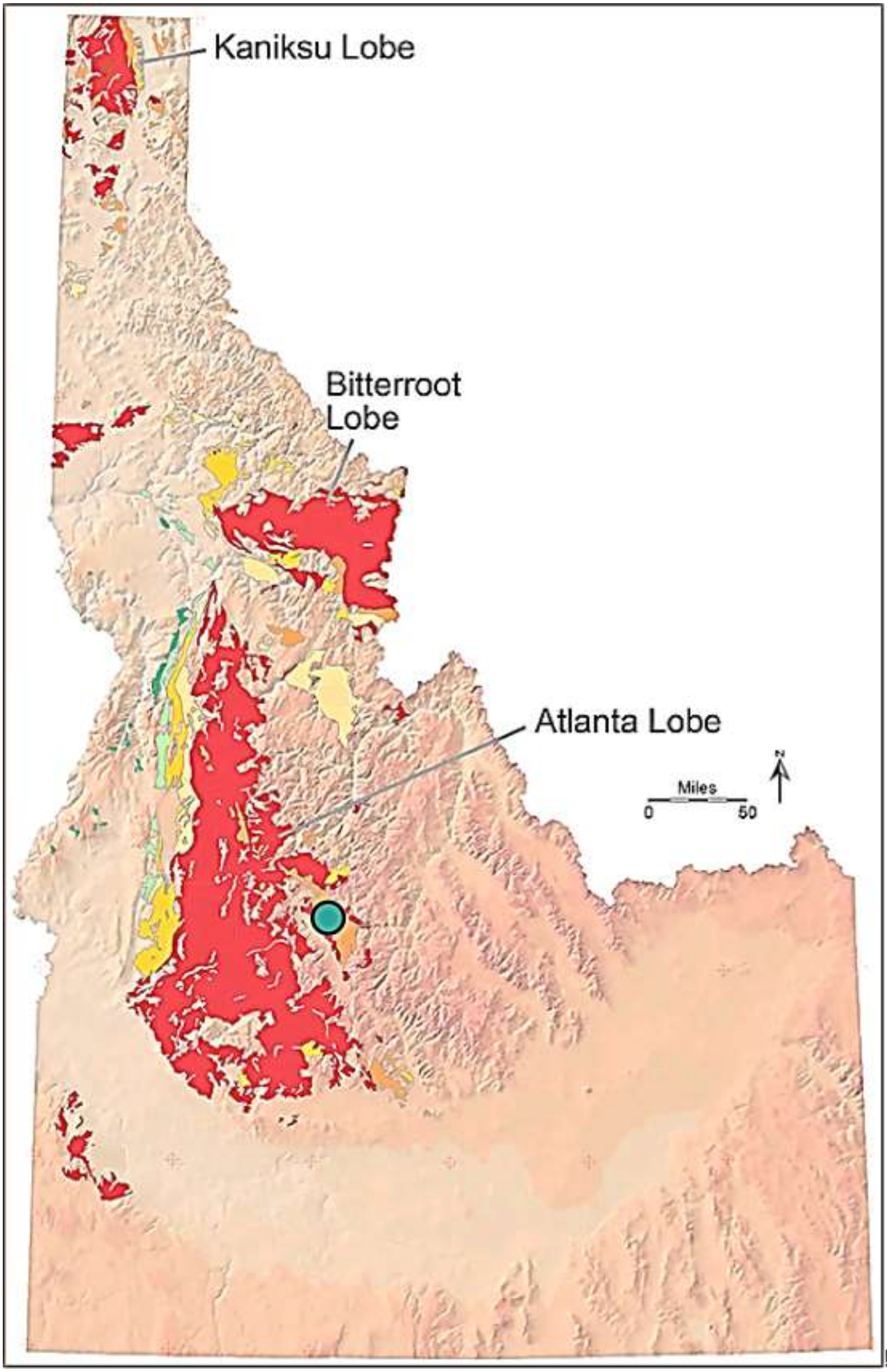


Figure 5: Map of Idaho Batholith from Digital Geology of Idaho, showing location of Stanley. Adapted from https://www.isu.edu/digitalgeologyidaho/idaho-batholith/

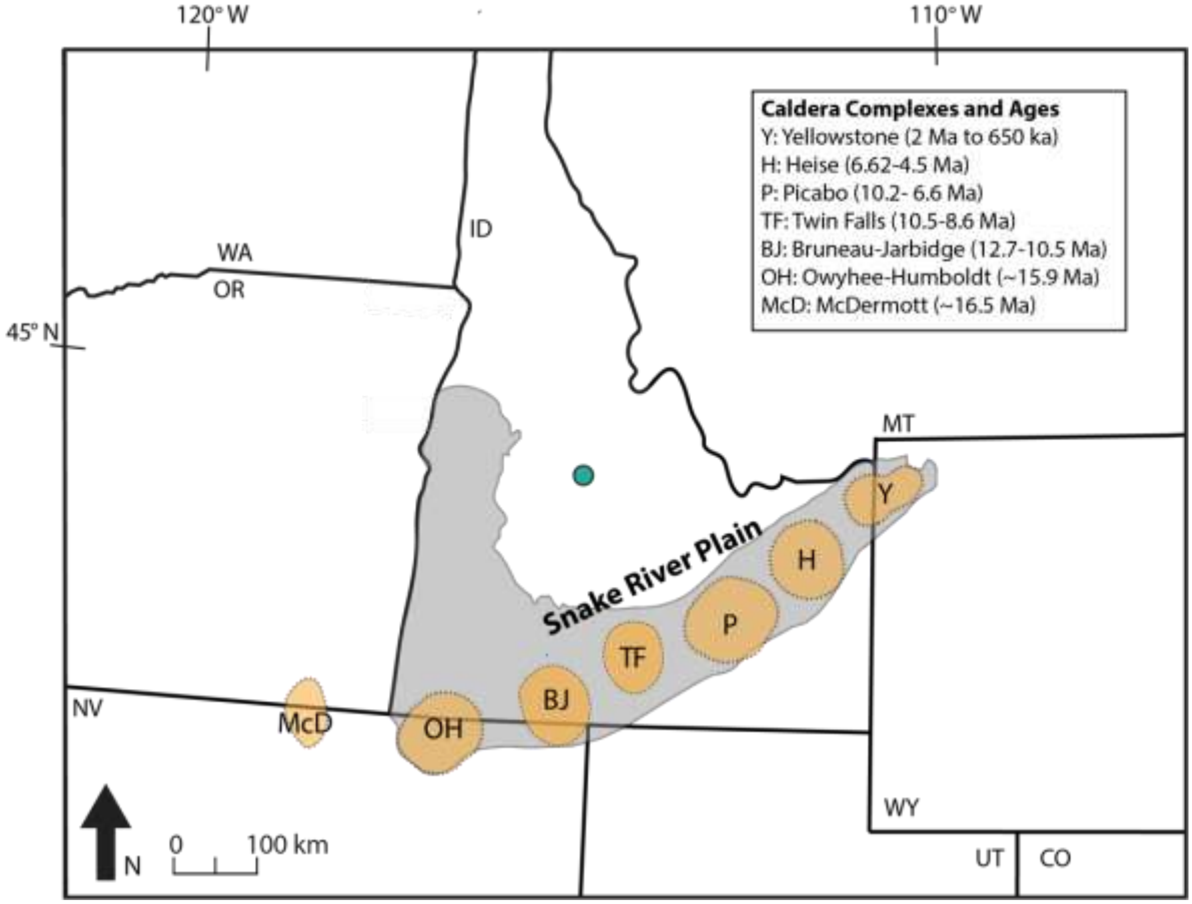
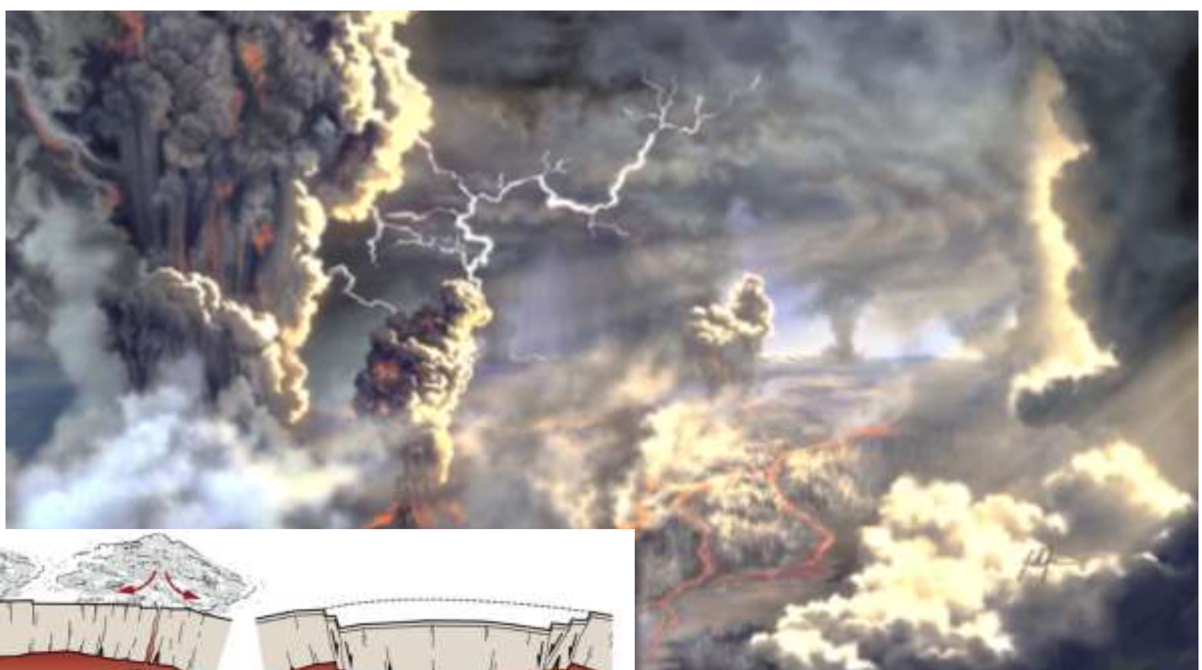


Figure 6: Map showing caldera complexes along the Yellowstone-Snake River Plain hotspot track and the location of Stanley, Idaho (blue dot). Adapted from Potter et al. (2018)



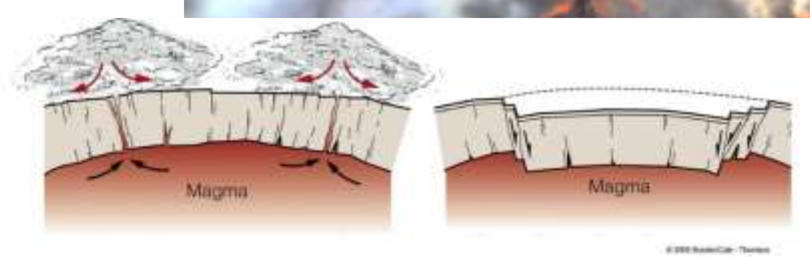


Figure 7: Artistic representation of a supervolcano eruption, with an inset showing a cross section of how these eruptions take place along ring fractures encircling the magma reservoir.

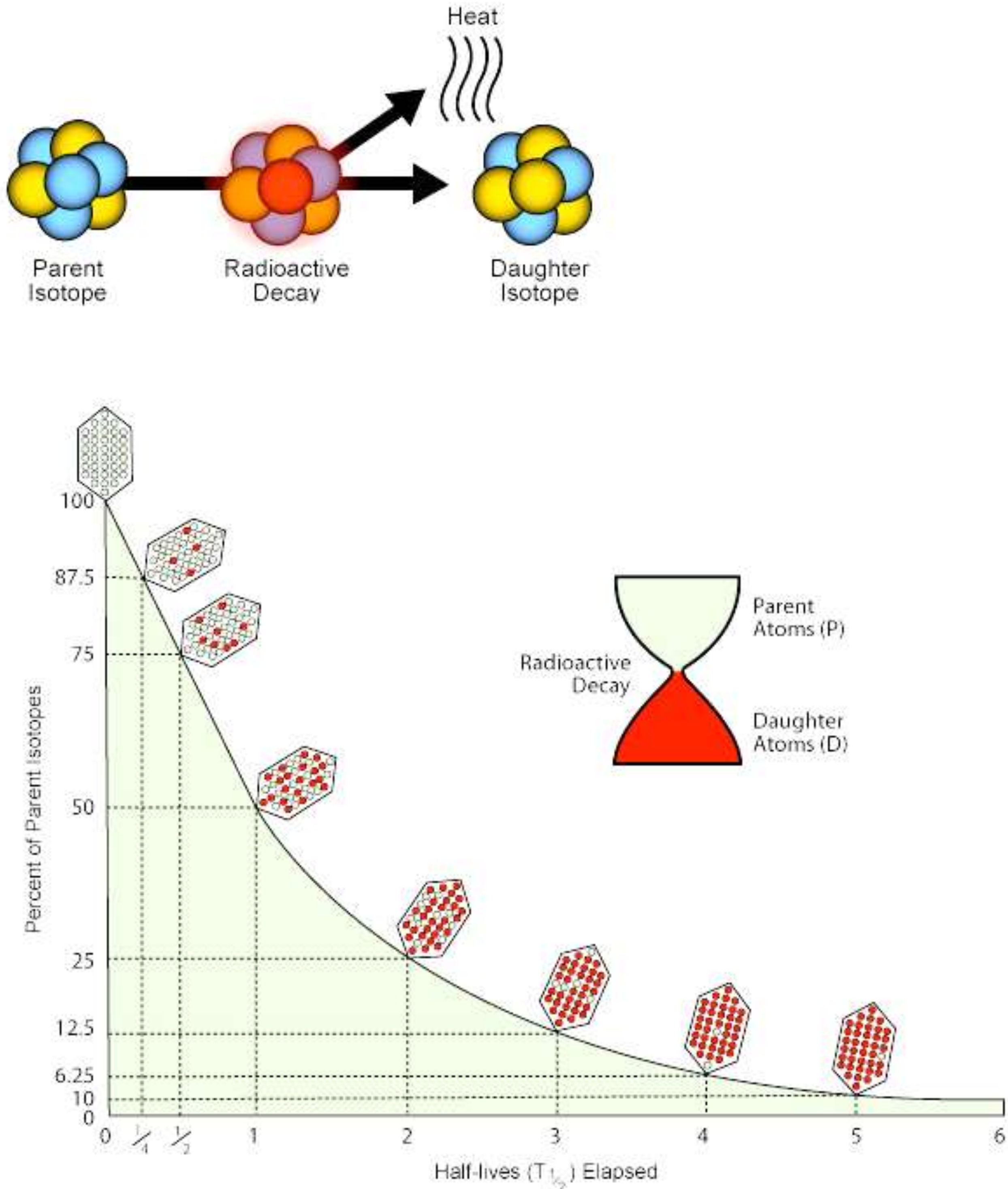


Figure 8: illustration of radioactive decay (parent to daughter isotopes) and half-lives from NOAA Ocean Exploration (https://oceanexplorer.noaa.gov/edu/learning/15_seamounts/activities/coral.html)

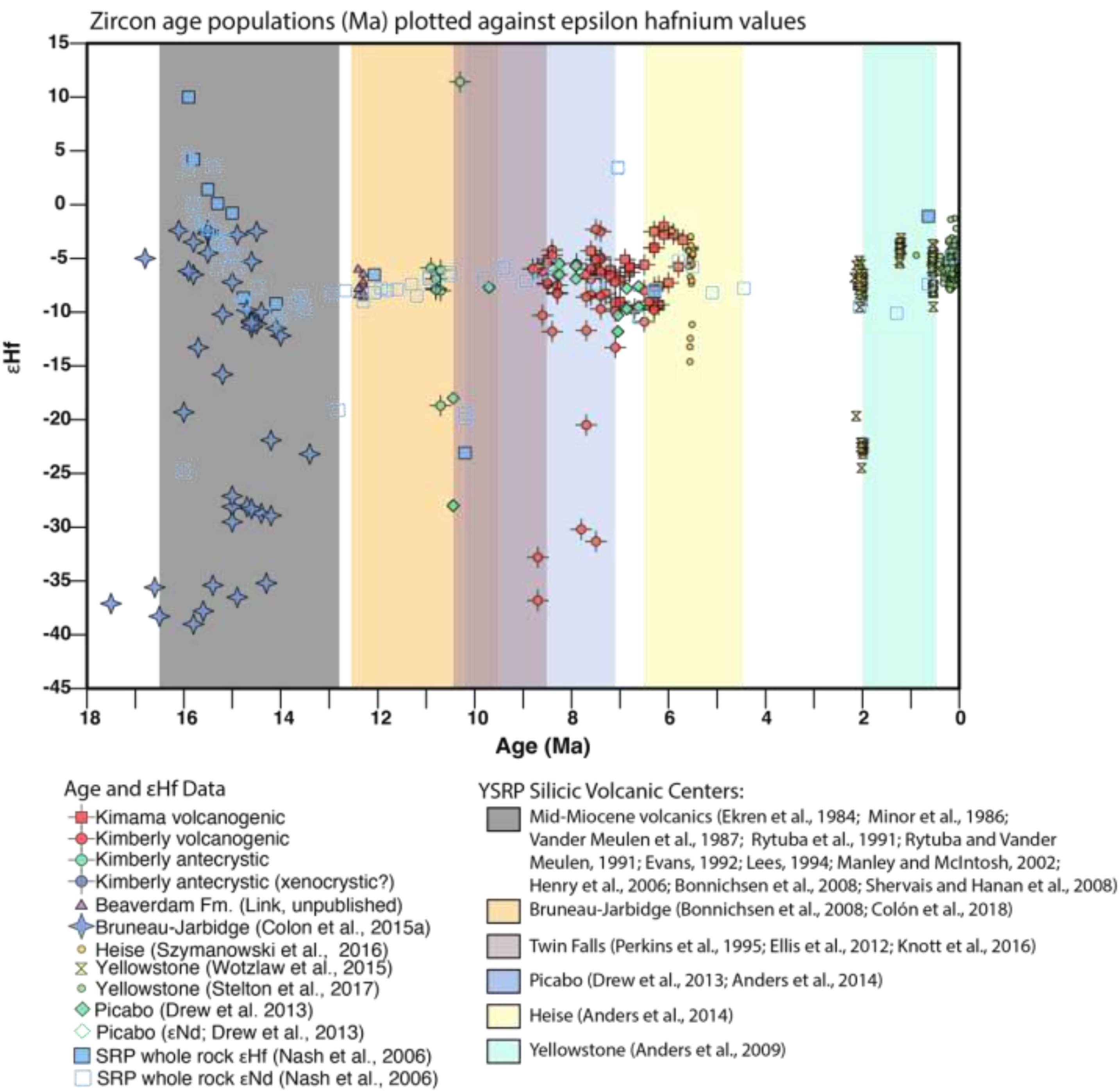


Figure 9: graph showing distribution of age and hafnium values from zircons sampled from supervolcano ash deposits along the Snake River Plain and west of Yellowstone. The left side of the plot corresponds to the westernmost Snake River Plain (McDermott) and moves eastward through successive supervolcano deposits, with the right side of the plot corresponding to Yellowstone (modified from Potter et al. (in prep)).

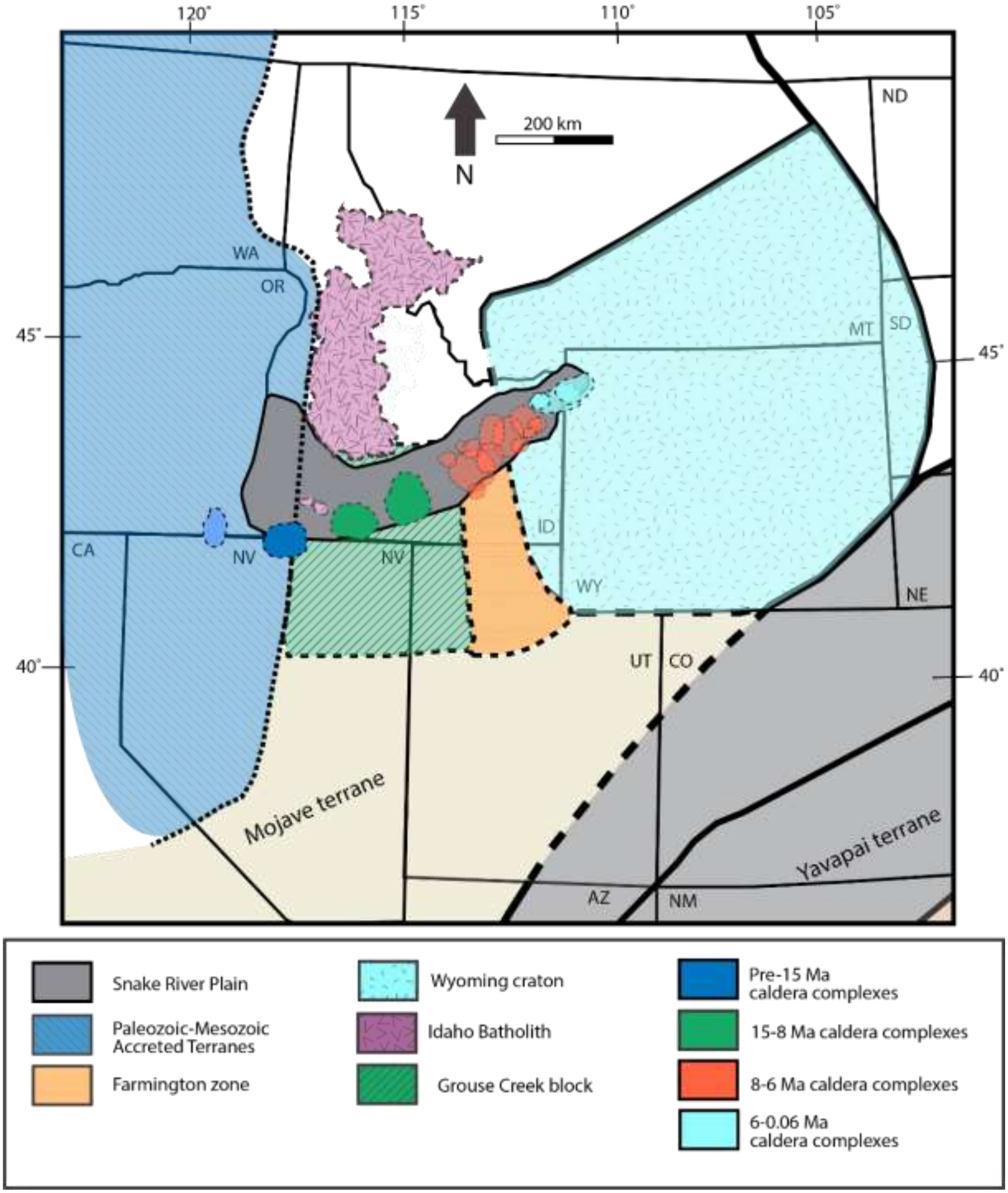


Figure 10: Map showing the inferred crustal architecture of the western U.S. The Mojave and Yavapai terranes are ancient oceanic islands that accreted, or squished against, North America 2.5 to 1.2 billion years ago just like the more modern 150-100-million-year-old oceanic islands that are to the west of Idaho. The Wyoming craton is a fragment of the ancient North American continent and is made of metamorphosed granites. The Grouse Creek block, just below the Idaho Batholith, is also primarily composed of metamorphosed granites, but is slightly younger than the Wyoming craton. Both are separated by the Farmington zone, an area of heterogeneous geology including metamorphosed granites, basalts, and sedimentary rocks with an unknown origin. Caldera complexes are grouped by age. This map shows the change from large discrete caldera complexes to the west to smaller, nested caldera complexes to the east. Modified from Potter et al. (in prep).

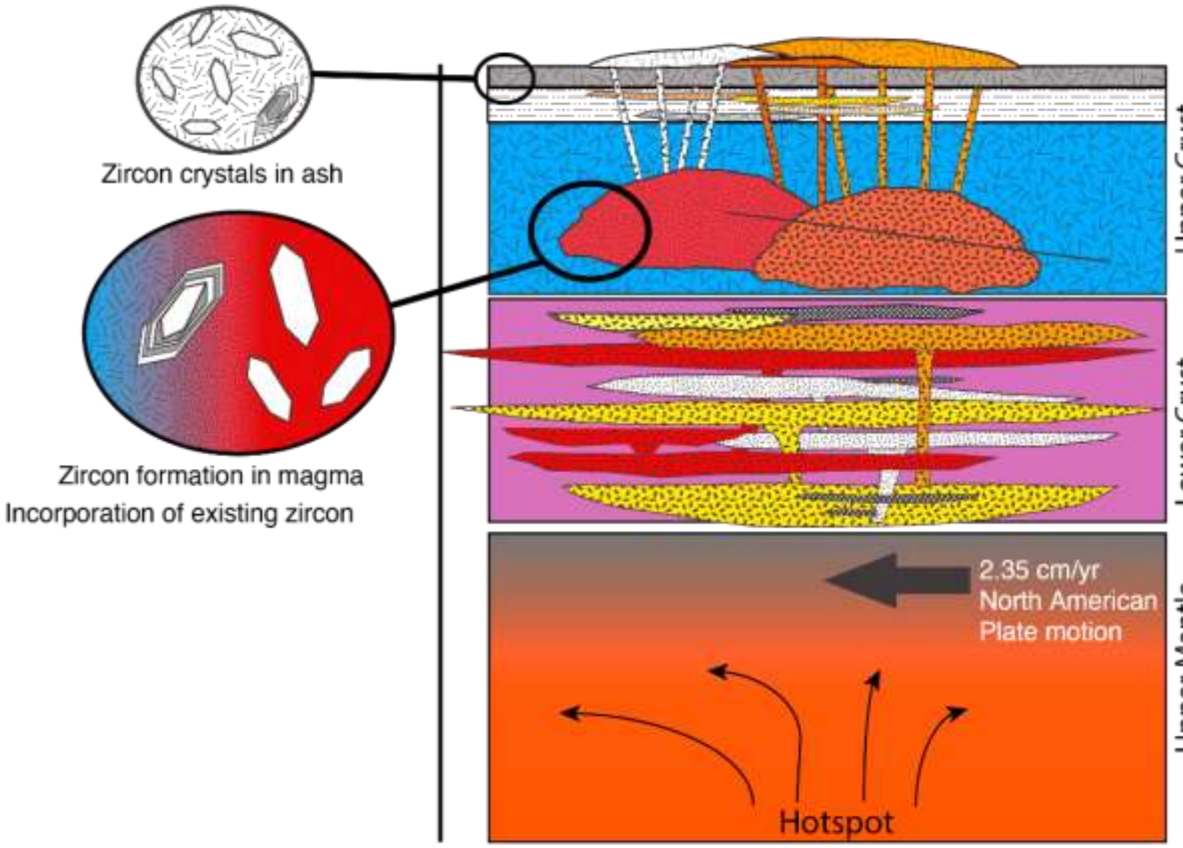


Figure 11: Figure showing how zircons are formed and integrated into igneous rocks and ash deposits. In the upper mantle, the Yellowstone-Snake River Plain hotspot heats and melts the overlying crust as the North American plate slowly migrates to the SW at a rate of 2.35 cm/yr. In the lower crust, stacked magma reservoirs known as sills contain magma that is basaltic in composition and has stagnated due to its higher density. However, this magma is still very hot, and can cause melting of the overlying continental upper crust, forming magma reservoirs of sticky magma close to the surface. These are the sources of supervolcano eruptions along the Yellowstone- Snake River Plain hotspot track. Zircons that crystallize in upper crustal magma reservoirs carry information about when they crystallized (uranium isotopes), and their magma source (hafnium isotopes). When a magma reservoir melts into surrounding rocks, it can pick up older, existing zircons and incorporate them into the magma without destroying their age and source information. This allows us to identify what portions of the crust melted to form Yellowstone-Snake River Plain hotspot magmas and understand how crustal architecture plays a role in the characteristics of Yellowstone-Snake River Plain supervolcano eruptions. (modified from Potter et al. (in prep.)).