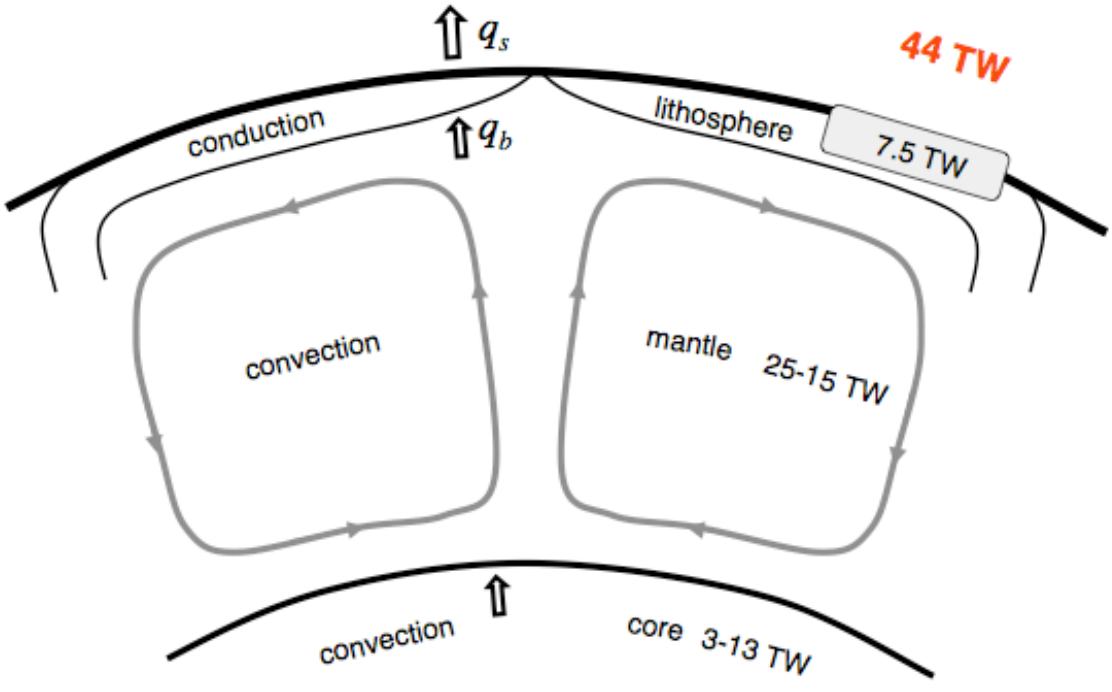
Heat Flow Considerations

(from Jerry Schubert's lecture at IGPP, Fall, 2000)

- Heat flow from the Earth is 44 TW.
- Heat flow from radiogenic heat production in the continents is 7.5 TW.
  This is uncertain since we do not really know the amount of U, Th, and K in the continents, nor do we know the heat flow from the mantle into the base of the continental lithosphere.
- Heat flow from the mantle is 36.5 TW =
  Heat from the core +
  Heat from mantle cooling +
  Heat from radioactivity.



Heat Flow From the Mantle 36.5 TW

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Heat flow from core: 2.4 TW [Sleep, Davies]
13.4 TW [Malamud & Turcotte]

Urey Number = (radiogenic heat)/(total heat)

Heat flow from mantle cooling
if Ur = 0.75 9.1 TW

Heat produces by radiogenic sources in the mantle is 14 - 25 TW?

Heat Flow Considerations

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- Kellogg et al., [1999] have argued that the MORB source region is so depleted in radioactivity (heat production) that were it identical to the entire mantle, it could not supply the heat observed to be escaping through the earth's surface.

- According to this argument there must be an isolated region of the mantle with a higher concentration of Ur, Th, and K compared to the MORB source region.

- Kellogg et al., [1999] hypothesize that this region is a compositionally distinct (undepleted, rich in radiogenic elements, ^{3}He and ^{40}Ar), variable thickness, separately convecting layer buried at the bottom of the lower mantle. However, the constraints on mantle radioactivity are not so certain.