**Wilson Cycle 5**

1. And now for the penultimate stage – Cordilleran-Type mountain building.
2. Cordillera refers to a very long range of mountains. The Andes are a good example.
3. The Andes were formed by the subduction of oceanic lithosphere beneath a continent.
4. Many of the elements seen in ocean to ocean convergence (island arc type orogeny) are also seen in ocean to continent convergence (Cordilleran type orogeny). Let’s see if you can identify them. What’s this? …
5. Yep, that’s a trench.
6. Now let’s try one that’s a little harder. I’ve given you a hint.
7. … that’s right! It’s an accretionary wedge.
8. Ok, now for the hardest one.
9. If you picked forearc basin, give yourself a reward, because you’re doing really well! By the way, what kind of sediments would deposit here? Note the nearby volcanism.
10. Yah, there would probably be a lot of lithics, but because the volcanoes are emplaced within a DCM, sediment sources would be more variable than for an island arc.
11. Mountain building is only in part due to volcano growth. Compression produces thrust faults and further uplift.
12. Most of the mountains in the Andes are not volcanic. The uplift is mostly due to thrust faulting.
13. Magma formation is similar to that in island arc type orogeny. So what kind of melting happens here - wet melting or decompression melting?
14. Did you guess wet melting? Then punish or reward yourself appropriately. Any time oceanic lithosphere is subducted sea water is carried into the mantle, and that causes wet melting.
15. Ok now, when a mafic magma becomes more felsic by separating the low-melting point, high-silica minerals from the high-melting point, low-silica minerals, what is this process called?
16. It’s fractionation, but partial melting or magmatic differentiation are correct too.
17. Ok, now what type of magma forms over subduction zones – ultramafic, mafic, intermediate or felsic?
18. The magmas will be intermediate. If you got that right, then you are really beginning to catch on! As you have seen, subduction beneath continental lithosphere produces very similar processes and products to subduction beneath oceanic lithosphere. However, there are a few important differences. First, because continental crust is much thicker than oceanic crust, much more of the intermediate magma will get stuck within the continent, which means more plutonic rocks like diorite, and less volcanic rocks like andesite.
19. Second, because the arc of volcanoes is formed on continental crust, they will not form islands. We’ll still get a volcanic arc. It just won’t be a volcanic island arc.
20. And one more difference… with Cordilleran orogeny, there will be the thick pile of DCM sediments to consider that did not exist in the island arc situation.
21. The Barrovian metamorphism (remember that means both higher pressures and temperatures with depth) which accompanies subduction orogenies, will now metamorphose those DCM sediments in addition to the volcanic and plutonic rocks.
22. In some situations, spreading can occur behind the volcanic arc. We will discuss back arc spreading at a later time.
23. Meanwhile the mountains produced by continent - island arc orogeny have a chance to wear down to a peneplane - a broad, nearly level surface, not much higher than sea level.
24. And now for the grand finale! We build a new supercontinent by continent-continent collision.
25. Continent-continent collision is sometimes called a “hard” collision.
26. As with all collision orogenies, there will be a foreland, hinterland and
27. … suture zone where they meet.
28. Let’s look at this diagram from the opposite direction so we can better compare it with …
29. … this more detailed diagram of a continent-continent collision orogeny. You’ll notice many of the same features that we saw in continent-island arc collision. There some important differences, however. Here, both hinterland and foreland bring DCM sediments into the collision zone. Since those of the hinterland were subjected to Barrovian metamorphism the suture zone here is comprised of a more complex mix of rock types than in continent-island arc orogeny.
30. Also different here is the severity of hinterland thrusting due to the much “harder” collision between two continents. Think of continent-island arc orogeny as analogous to a head-on collision between a Mack truck and a Volkswagen, whereas continent-continent orogeny involves two Mack trucks.
31. An impressive foreland basin will form …
32. … over deformed foreland DCM sediments.
33. These will be buried by …
34. … a clastic wedge derived from the collision-formed mountains. The style of deposition changes…
35. ... over time….
36. … but eventually…
37. … the entire foreland basin is filled, as all the mountains are worn down, …
38. … a vast peneplane develops, and …
39. … a new stable continental craton emerges to start the cycle again.
40. Wow!! If you made it through all that and you can pick out all the elements of the various Wilson Cycle stages within the craton, you are doing amazingly well! You’ve got a really good idea how the earth works on the large scale and nothing in this course should be beyond your understanding. If you didn’t get all that, please know that we will cover this information again and again as we see how individual parks fit into the context of the Wilson Cycle. Nothing in this class is more difficult than the Wilson Cycle, but nothing here is more central to understanding.