**Earth and Life**

*Tibet: the geological history*

**Voice Over**
Time now to look at that geological history and a journey that takes us onto the Tibetan Plateau itself. We join an international group of scientists on a reconnaissance expedition across the plateau. Their findings will help to determine the shape of future research in Tibet. Most of the journey was across inhospitable terrain over four and a half thousand metres in elevation. What happened to make the Tibetan land mass so high?

**Caption: Nigel Harris, Open University**
150 million years ago I would have been standing on the southern edge of Asian continent. And far away to the south there would have been an ocean, the Tethys Ocean, stretching for thousands of kilometres, and on the other side of that ocean there was the Indian continent. Now plate tectonics dragged the Indian continent closer and towards the Asian continent.

**Voice Over**
The separation of Africa, America, Antarctica and India happened during the age of the dinosaurs. Continents were driven across the Earth's surface. India drifted north, shrinking the ocean on its northern coastline as it moved. Then, between 50-60 million years ago, India collided with Asia.

**Nigel Harris**
Here we can see strata which originally would have been laid down horizontal, and now they've been deformed, they've been upturned, they've been folded, they've been totally scrunched about, showing the impact of that major collision.

**Voice Over**
The Earth's crust thickened as a consequence of this momentous event, pushing up the Tibetan Plateau. During the collision India has moved a further two thousand kilometres north into Central Asia. The uplift of the Himalayas was the grand finale of this tectonic drama. But while all this mountain- building has been going on there must have been massive erosion at the same time, and these two processes together – uplift and erosion – might explain the pattern of climate change following collision.

**Caption: Peter Molnar, MIT**
You have to cause climate change somehow; if the growth of the Tibetan Plateau were in a high area it can cause climate change, and then climate change can accelerate erosion, well then you have what we would call positive feedback, one accelerates the other and they feedback on one another.

**Maureen Raymo**
You can do two things to a rock: you can break it up and you can dissolve it, but when you start dissolving it ultimately what you're doing is taking CO2 out of the atmosphere. CO2 in the atmosphere dissolves some rainwater, makes a very dilute acid and, you know, attacks, edges the rock, and when it dissolves bits of the rock the elements recombine to form new minerals, and in the process the CO2 that was in the atmosphere ultimately ends up in a carbonate rock, so basically the rivers are the conveyor belt taking the carbon from the land to the ocean where it's effectively removed from the atmosphere.

**Voice Over**
Both Raymo and Berner agreed that chemical weathering led to removal of CO2 from the atmosphere, but Raymo was now suggesting that global cooling of the past fifty million years

was caused not by a change in sea floor spreading rates, but by a strong monsoon falling on a rising Tibet.

**Maureen Raymo**
Generally in the textbooks that I was reading in the early ‘80’s people assumed that chemical weathering was a function of rainfall, land area, temperature, these factors, and according to this logic you would think that the enzyme rainforest, for instance, would have the most chemical weathering in the world 'cos they’ve had all these factors. But one day I was sitting a class and one of the professors put up some numbers on the board and these were numbers of river discharge of dissolved material, so rock-dissolved material, and it was a very high number coming out of South East Asia, this area, and that stimulated me to go to the original papers by the few geochemists that are out there actually measuring stuff in rivers, and you know when I started really digging into a lot of the recent literature I realised that actually a lot of chemical weathering was going on in mountainous regions.

**Voice Over**
Berner’s model rested on the fact that chemical weathering rates increased with temperature but Raymo and Ruddiman took the opposite view and suggested the uplift of the Himalayas actually caused global cooling. For them chemical weathering had increased as temperatures dropped due to the rising plateau. Were they right? Again Tibet held the clue.