ASSEMBLING THE AFRICAN CONTINENT

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Defining the arrangement of continents through time and the processes that brought disparate subcontinents and island chains together is essential not only to understand the history of planet Earth, but also the evolution of complex life, past climates and non-renewable resource occurrence. Like all other continents, Africa was sutured together by tectonic plate collisions of older separate continents, a process that is similar to the current collision of the Indian subcontinent with Asia. Continental collisions that formed Africa also formed the supercontinent of Gondwana encompassing Africa about 500 million years ago. At that time, the suture zones were the locations of mountain ranges that rivaled the Alpine-Himalayan chain today. Remnants of these ancient mountain ranges cross Africa in roughly north-south and east-west trending belts where their deeply eroded roots are discerned. In some places the mountain roots are strikingly obvious in the landscape because the faults within them control the locations of modern faults, such as those that bound the Rift Valley.

One of the ancient suture zones, known as the Damara belt is located in northern Namibia. Rock structures within this belt are exceptionally well preserved and exposed in the Namib Desert. Our research in Namibia is focused on studying the Damara belt to better understand the plate tectonic processes that assembled southern Africa at the center of the Gondwana supercontinent.

In the field we measure the orientations of the folds and faults that formed during deformation of the rock layers before and during continental collisions. This allows us to reconstruct past tectonic stress fields that resulted from plates moving relative to one another, either orthogonally or at some oblique angle. In the lab, measuring the chemical compositions of minerals formed in the rocks when they were deep within earth tell us pressures and temperatures experienced by deformed rocks during mountain building episodes. We also measure the uranium and lead isotopes of the mineral zircon in crystallized magmas and recrystallized solid rocks to determine when they were hot and when they deformed. This "forensic" information allows us to reconstruct the history of mountain building in different areas of the Damara belt, and subsequently determine the sequence of collisions between southern Africa (the Kalahari continent), central Africa (Congo continent) and southern South America (Rio de la Plata continent).

Zircon grains in sedimentary rocks of the Damara belt allow us to trace the provenance of detritus that originally formed the rocks that were caught up and deformed between the subcontinents. By measuring the ages and compositions of many zircons throughout the Damara belt we gain clues to answer other questions including if the Congo continent was ever near the Kalahari continent before Gondwana formed. The combination of these approaches is providing us with information on a larger scale about the Earth's supercontinent tectonic cycles.

Our research was supported by grants from the National Science Foundation and the Australian Research Council. A new NSF proposal is currently in review to continue the research for three years. Our previous research teams have included scientists and students from the University of Namibia, researchers from Australia and Germany, and graduate and undergraduate students from UF. If our proposal is funded, the research team will include new collaborators from Utah State and Montana State Universities and provide graduate and undergraduate research projects.

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