Narrative Progress Report

PRF#: 57500-UR
Project Title: Provenance by Petrology and Age-Dating of Zircons: Cretaceous Sandstones of the Arkansas Coastal Plain
PI Name, Affiliation: Haibo Zou, Department of Geosciences, Auburn University
Co-PI name, Affiliation: David King, Department of Geosciences, Auburn University

1. The Progress of Research

We have obtained 7 subsurface sandstone samples from Arkansas, thanks to the assistance from Dr. Peng Li of Arkansas Geological Survey. We have picked 100 or more zircons from each of these 7 samples and analyzed zircons from two of the samples (Cotton Valley Group and Hosston Formation) in the first year.

We have analyzed 60 zircons from the Upper Jurassic Cotton Valley Group and 38 zircons from the Lower Cretaceous Hosston Formation by U-Pb method using secondary ion mass spectrometry at University of California at Los Angeles. The age distributions are given in Figs. 1A and 1B.

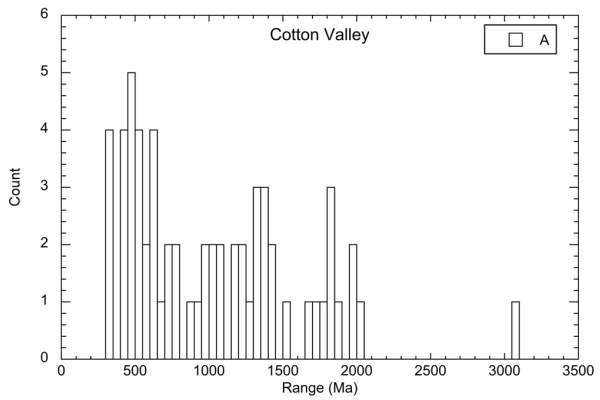

Fig. 1A. U-Pb age distributions for zircons from the Cotton Valley Group (Upper Jurassic-Lower Cretaceous).

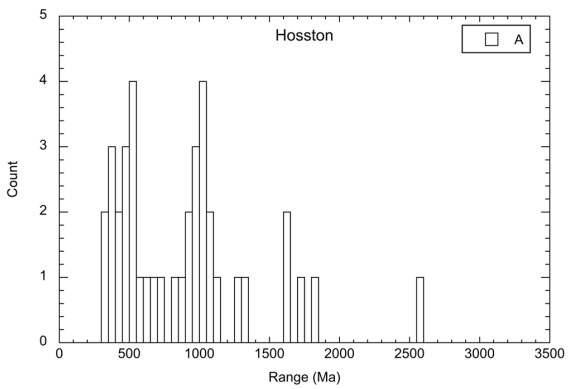

Fig. 1B. U-Pb age distributions for zircons from the Hosston Formation (Lower Cretaceous). With more age data from these 2 samples and new age data from other 5 samples, we will make relative age-probability plots to compare all 7 samples when we prepare for Year 2 report and journal publications.

Cotton Valley Group (Upper Jurassic-Lower Cretaceous):

The age data for 60 zircons from the Upper Jurassic-Lower Cretaceous Cotton Valley Group define a complex distribution from 308 Ma to 3.06 Ga and reflect multiple source terranes. The age spectrum shows the dominance of Taconic and Acadian (490-350 Ma) zircons. Grenville-age (1300-950 Ma) detrital zircons are a strong component. Four grains are Alleghenian (330-270 Ma) zircons. The above features indicate an Appalachian source. The zircons with ages of 500-548 Ma may be derived

from the southern Oklahoma basement. The relatively abundant 562-792 Ma zircons may reflect a source from Lapetan rifted margin of Laurentia. This age spectrum shows many grains older than 1500 Ma. Because Appalachian zircons generally lack grains older than 1500 Ma, another source is suggested. These grains older than 1500 Ma may be derived from the Paleozoic rocks of the Ouachita Mountains. One grain is 3.06 Ga, which is one of the oldest zircons reported in the region. The ultimate source for this Superior-age grain might be from the Midcontinent.

Hosston Formation (Lower Cretaceous):

The age data for zircons from the Lower Cretaceous Hosston Formation define a complex distribution from 326 Ma to 2.57 Ga and reflect multiple source terranes. There are two age peaks with similar abundance: the Taconic and Acadian zircons and Grenville-age zircons. The zircons with ages of 502-523 Ma may be derived from the southern Oklahoma basement. The zircons with ages of 559-735 Ma may be derived from Neoproterozoic to Early Cambrian synrift volcanic and plutonic rocks from the Lapetan rifted margin of Laurentia. Zircons older than 1500 Ma are also present (10.5%) from the Hosston Formation, but are less abundant compared with the Cotton Valley zircons (16.7%), probably reflecting less contributions from the Ouachita Mountains. There is one Superior-age grain (2570 Ma), with ultimate source from the mid-continent.

Our preliminary data show that the zircons from Upper Jurassic-Lower Cretaceous Cotton Valley Group and Lower Cretaceous Hosston came from both the Appalachian Mountains and the Ouachita Mountains, with contributions from the Oklahoma Basement and the Lapetan synrift.

We are in the process of analyzing detrital zircons in samples from the (younger) Upper Cretaceous sandstones from Arkansas. We expect to complete the analyses in Year 2. A manuscript for journal publications is expected to be ready for submission in Year 2.

2. Impact of Research on PI's career and that of the students

This research support from ACS-PRF allows PI Zou to change his research direction from igneous rocks to clastic sedimentary rocks, from igneous zircons to detrital zircons, from uranium-series disequilibrium dating of young (<0.35 Ma) zircons to U-Pb dating of older zircons, from East Asia to south USA, and from deep mantle processes to Earth surface processes. For co-PI King, this project expands his work on Upper Cretaceous strata in the eastern Gulf coastal plain and the coastal plain of Belize to Arkansas and adjacent areas of the Gulf coastal plain in that region. The research provides educational training in fundamental petroleum science for two undergraduate students and a graduate student, and will enhance their interests and skills for future research in fundamental petroleum fields.