

Mesozoic drainage evolution and paleogeography of the Eastern United States

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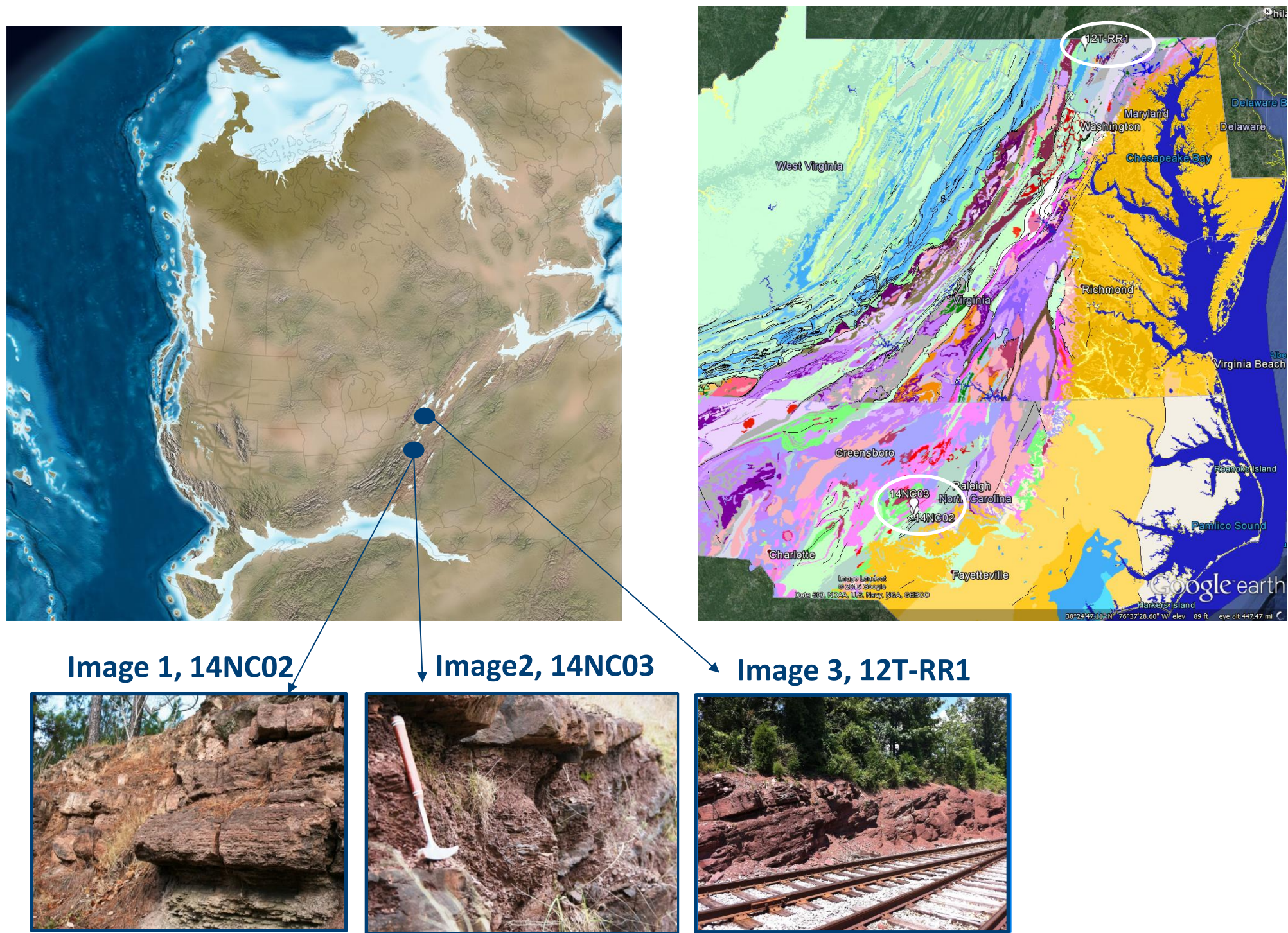


Abstract

The Upper Jurassic Norphlet Formation eolian sandstone in the subsurface of the southeastern U.S. contains detrital zircon U-Pb ages that reflect mixing of Laurentian and Gondwanan ages that form four major populations: 250-500 Ma, 500-700 Ma, 900-1400 Ma, and 1950-2250 Ma. The origin of Neoproterozoic zircon in the Norphlet Formation could be from the Carolina terrane of the east-central U.S. or the Suwannee terrane of Florida. If Neoproterozoic zircon in the Norphlet Formation was derived from the Carolina terrane, then detrital zircon age signatures observed in the Norphlet Formation should be observed in the Triassic-Jurassic Newark Supergroup deposits preserved in Central Atlantic margin rift basins. It has been hypothesized that the Newark Supergroup basins consisted of half-grabens, some of which became stratigraphically linked during the latest stage of rifting. In order to test this idea, detrital zircon ages can be compared between Norphlet Fm. sandstone and Newark Supergroup clastics of the Deep River basin in North Carolina, one of the southernmost exposures of these Mesozoic rift basins along the Central Atlantic Margin. Two samples of the Chatham Group were collected from the Triassic sandstone of the Deep River basin for detrital zircon provenance analysis. The Sanford Formation is exposed in a 3 m thick outcrop located Along NC 42, 6 km E of Deep River., 10 km NW of Sanford, NC. The Sanford Formation here consists of gray sandstone, reddish siltstone, and grey fragmented mudstone/shale with poorly sorted subangular to rounded pebble-boulder conglomerate with clay/silt matrix. Beds in the sampled outcrop exhibited a coarsening upwards sequence, evident of higher energy depositional conditions over time. The Pekin Formation is composed of medium-bedded brown fine-grained sandstone to siltstone interbedded with laminated shale beds. Detrital zircon provenance analysis will be used to determine if these alluvial-lacustrine Triassic deposits were recycled in the to supply sediment to the middle Jurassic Norphlet erg.

Paleogeography & Paleoenvironment

Non-marine rift basins often exhibit tripartite stratigraphy. Tripartite stratigraphy is characterized by a transition from fluvial to lacustrine to fluvial facies (Olsen and Kent, 2000). The breakup of Pangea during the Mesozoic records this sequence in the Newark Supergroup's Deep River and Gettysburg Basins.



Outcrop Description & Sandstone Composition

Deep River Basin

Sanford Formation

Basal mudstones and siltstones followed by red hummocky sandstone, overlain by subangular-rounded conglomerate. Skolithos ichnofacies trace fossils are present in the Sanford Formation (Image 4)



Pekin Formation

The Pekin Formation presents interlaminated ½ m thick beds of sandstone and mudstone. 14NC03 is a chocolate brown, very fine grained sandstone, possible siltstone. Trough cross-bedding in the mudstone and bioturbation (images 5 and 6) in the sandstone are characteristic.

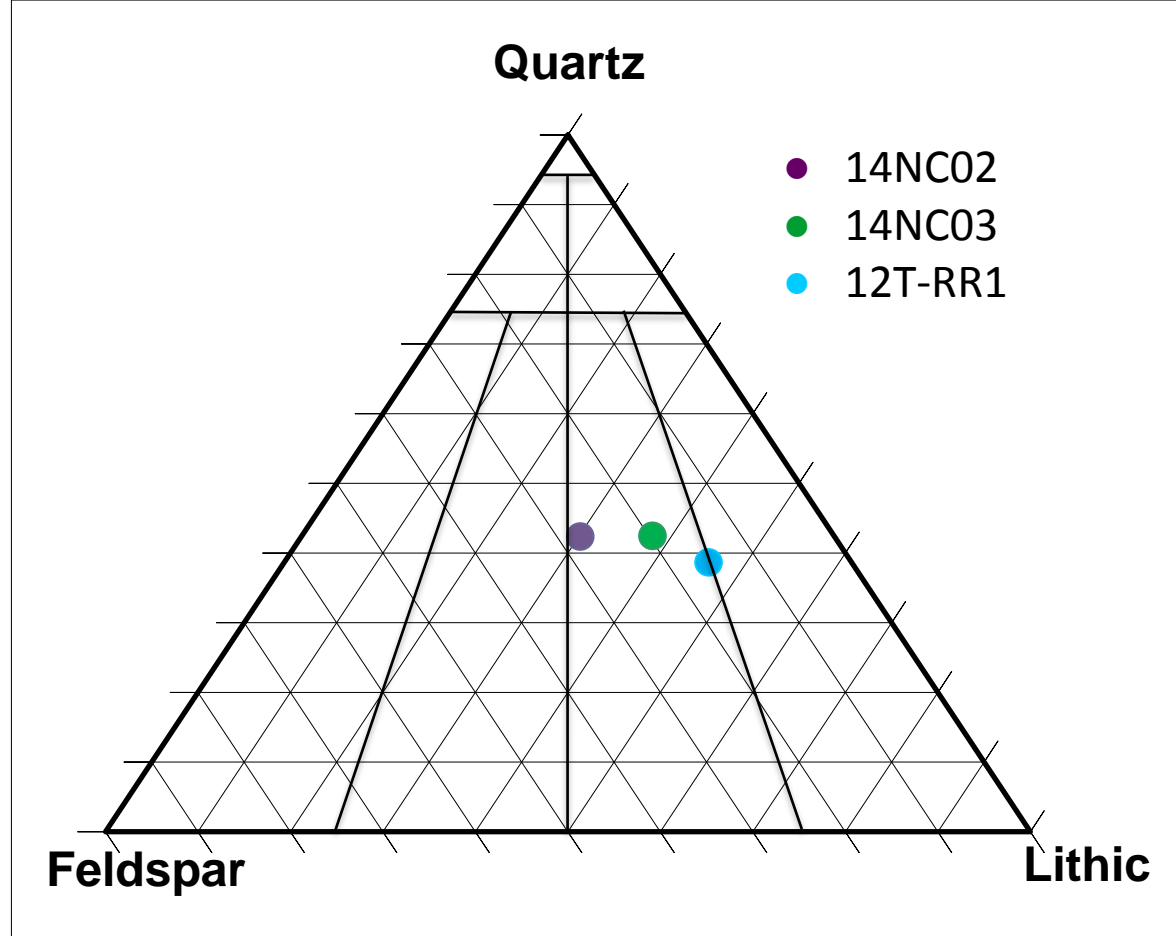


Table 1. Normalized modal framework grain composition.

Sample	Quartz (%)	Lithic (%)	Feldspar (%)
14NC03	42.46	37.90	19.64
14NC02	42.37	30.15	27.48
12T-RR1	38.66	45.88	15.46

Quartz:

Predominately Monocrystalline, undulose extinction; angular to subangular & grain diameter average of 0.1 mm to 0.2mm. Inclusions present (high order green birefringence)

Feldspar:

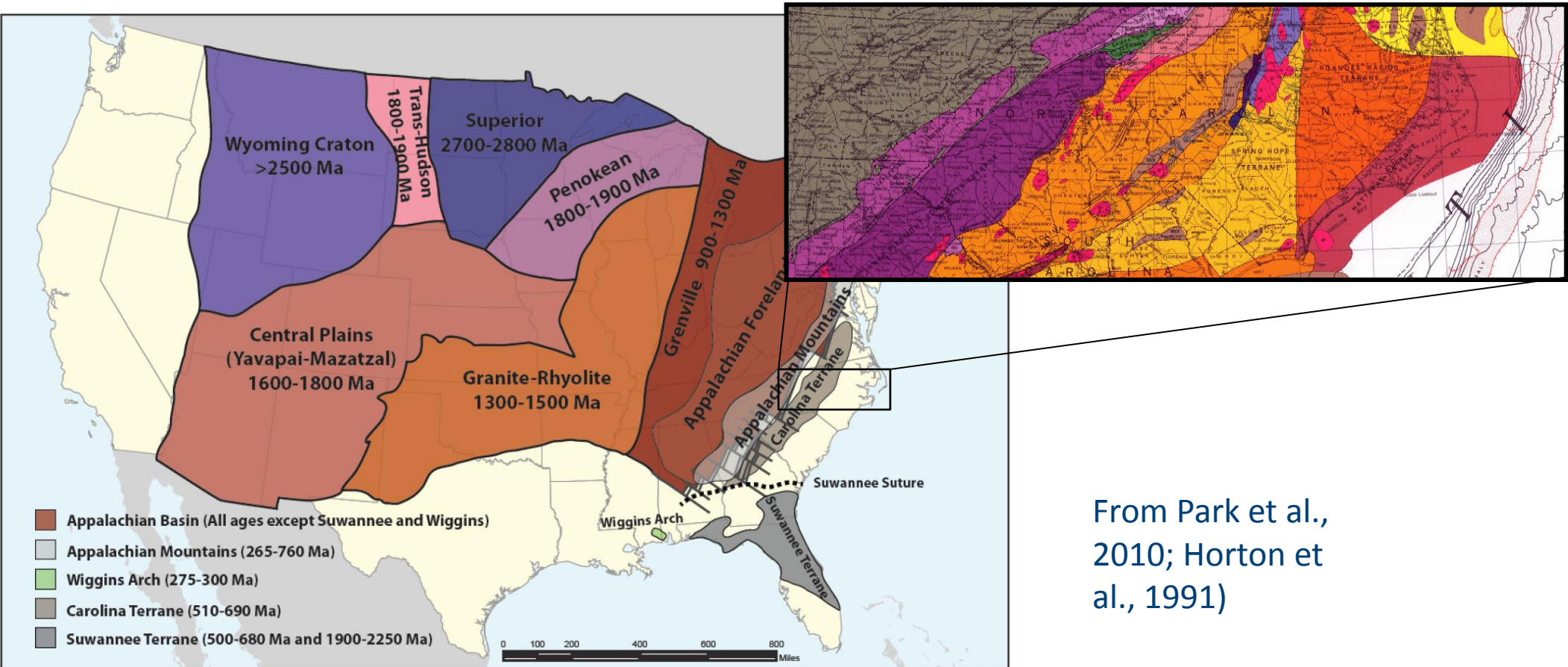
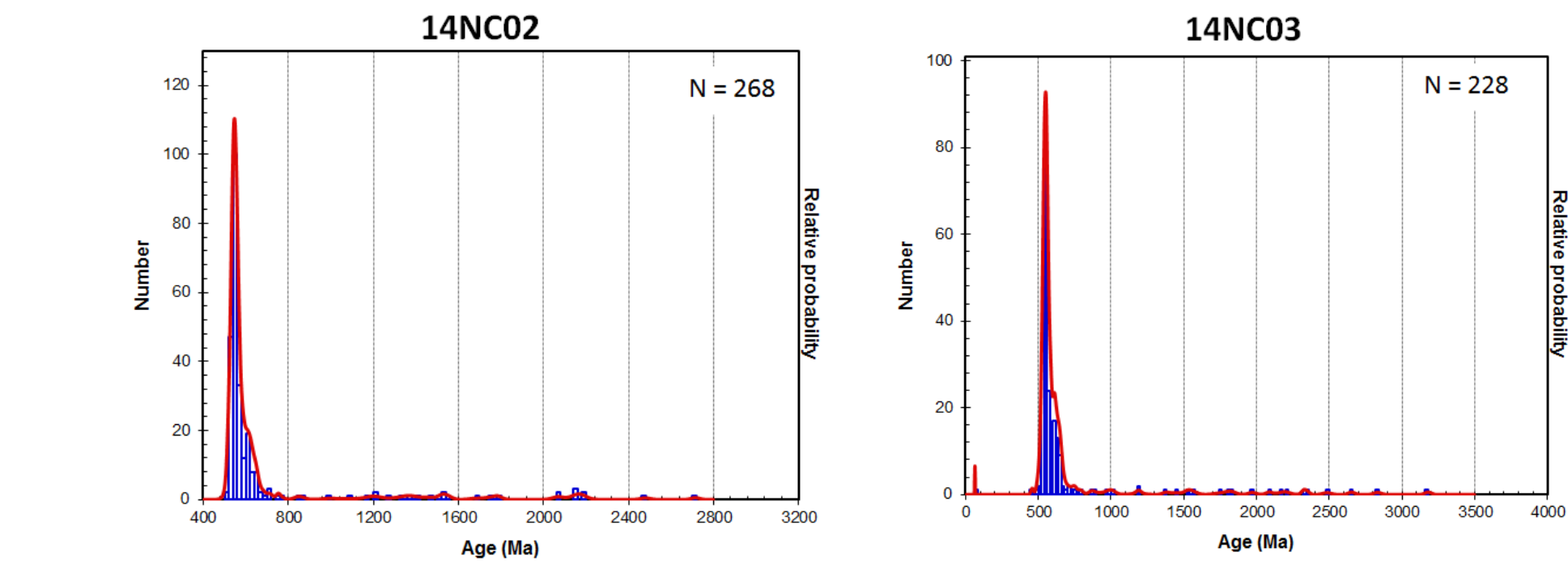
Contact, polysynthetic twinning and untwinned alkali plagioclase, orthoclase (microcline and potassium feldspar). Diameters up to 0.3 mm

Lithics:

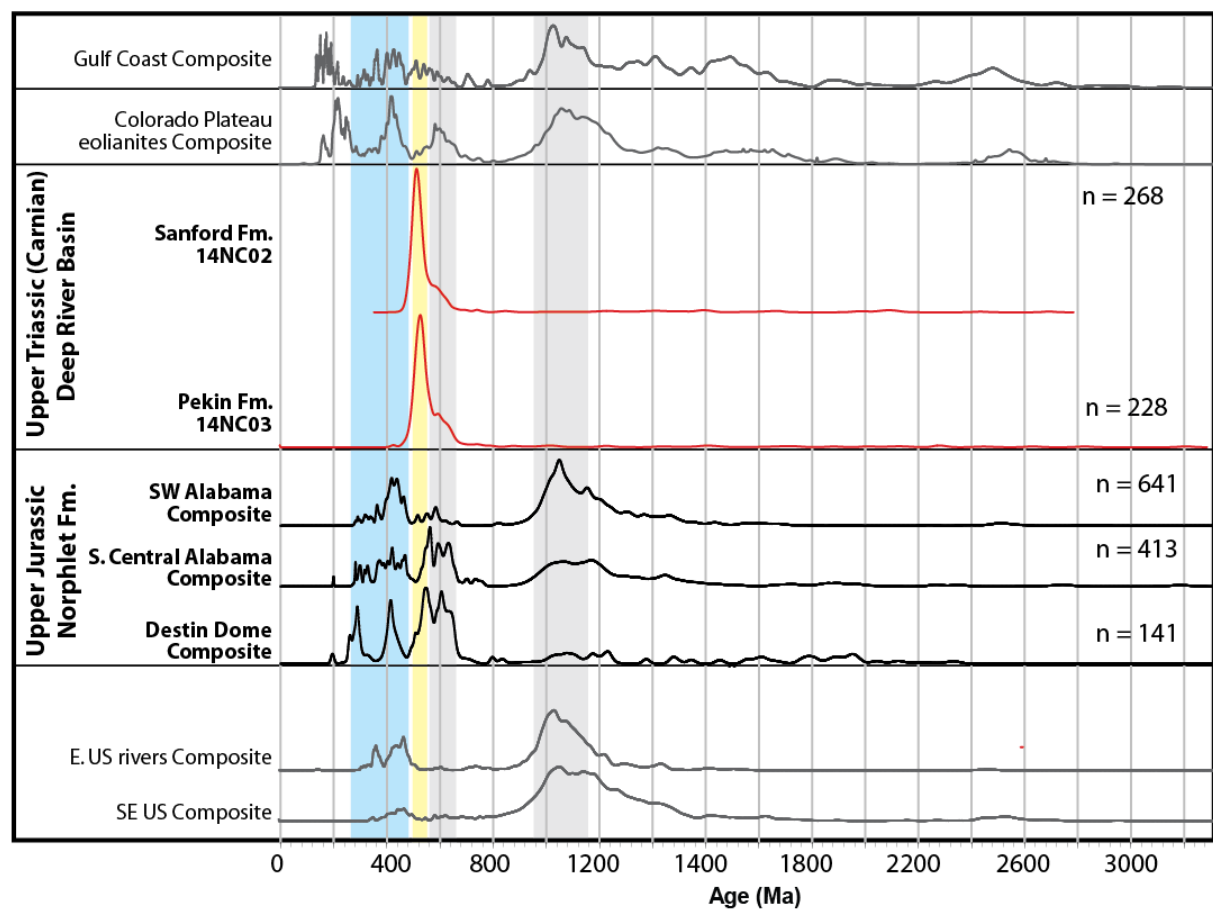
Sedimentary lithics composed of angular polycrystalline quartz, bladed muscovite, and feldspars. Diameters up to 0.4 mm

Sandstone composition description: All three samples plot within the feldspathic litharenite domain. 12T-RR1 is relatively high in lithics, respectfully. All samples contain opaque, isotropic iron oxide precipitate.

Detrital Zircon Age Results



From Park et al., 2010; Horton et al., 1991)



(Reference data from Voice et al., 2011; Dickinson and Gehrels, 2009; Weislogel et al., in revision)

Conclusions

The most probable source for the Carnian Deep River formations is the Albemarle Arc (Horton et al., 1991). Precambrian Grenville is not present in the DZ curve at all as the curves are unimodal. This suggests the Deep River Basin's formations are locally sourced and not derived from terrains draining Grenville (1000-1200 Ma material).

Acknowledgements

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