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Title

Petrology and Provenance of the Triassic Sugarloaf Arkose, Deerfield Basin, Massachusetts

Authors

Matthew P. Walsh, *University of Massachusetts Amherst Follow*

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Abstract

The ~2 km-thick Late Triassic Sugarloaf Arkose is the basal unit of the half-graben Deerfield basin, Massachusetts. Valley-river, piedmont-river, and alluvial-fan depositional facies within the arkose are defined by paleocurrent data and style of sedimentation. The valley rivers flowed from northeast to southwest, and the facies is present from the bottom to the top of the formation. Piedmont rivers built a megafan eastward into the basin, beginning about in the middle of the arkose. The local alluvial fan built from east to west in the upper-third of the formation.

The petrology of the medium sand and conglomerate was used to delineate the source areas for each facies. The medium sand in the valley rivers is mostly granite and granite gneiss fragments, coarsely-polycrystalline quartz grains, and twinned plagioclase. This assemblage is a mixture of granite from continental basement uplift, granite gneiss from a dissected magmatic arc, and phyllites and schist from a recycled collision orogen. The medium sand in the piedmont-river facies lacks granite fragments, and untwinned plagioclase is more abundant than twinned: the provenance is continental basement uplift and recycled collision orogen. The alluvial-fan provenance is similar to the valley rivers, combining recycled collision orogen and dissected magmatic arc. Unlike the valley rivers, granite gneiss and untwinned plagioclase in the alluvial fan are dominant over granite and twinned plagioclase. Quartz provenance in the three facies was granite, trending to granite gneiss in the piedmont-river and alluvial-fan facies.

In all facies, plagioclase feldspar is more common than K-feldspar in the medium sand. The conglomerate pebbles, however, are dominated by K-feldspar, most likely due to erosion of pegmatites in the source terrane. Gray quartzite, white and translucent varieties of quartz, and pink granitoid pebbles are also common.

The post-depositional diagenesis of the Sugarloaf Arkose affects provenance determination. Diagenetic events include: hematite grain coats, mechanical compaction, albitization of feldspars, albite and quartz overgrowths, authigenic hematite cement, carbonate cement, and illite replacement of feldspars.

Within the dry-dominated monsoonal paleoclimate, each facies formed in response to tectonism. The initial appearance of each facies is used to determine the timing of tectonic events. The valley rivers flowed from the northeast in an early NNE-SSW-trending 'sag' basin, associated with minor normal faulting. The initial appearance of the east-flowing piedmont rivers about half way up the section implies an early, down to the west, basin-bounding normal fault, which formed perpendicular to N70E-S70E extension. This fault propagated, and, on reaching the northeast corner of the basin, the alluvial fan built to the west off the fault scarp. The Amherst block is a relay ramp between basin-bounding faults in the Deerfield and Hartford basins. Linkage of the two basin-bounding faults through the Amherst block created an integrated basin linking the Triassic

strata in the early Hartford and Deerfield basins, and may have caused the unconformity present at the top of the arkose.

First Advisor

John F Hubert

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