New U-Pb detrital zircon geochronology from the Eocene San Jose Formation, eastern San Juan basin, northwestern New Mexico

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(1) INTRODUCTION & STUDY AREA - SAN JUAN BASIN, NORTHWESTERN NEW MEXICO

The San Juan Basin (SJB) of northwest New Mexico has received a considerable amount of study focused on determining the timing of Laramide deformation, provenance, and basin-scale sediment dispersal trends from Jurassic-earliest Paleogene strata. However, little is known about the sources and driving mechanisms for deformation and erosion that resulted in the deposition of Eocene synorogenic strata of the San Jose Formation in the SJB. The San Jose Formation has been subdivided into four units that include: (1) the basal Cuba Mesa Member (sand- and gravel-dominated facies), (2) the overlying silt-dominated Regina Member, (3) the sand-dominated Llaves Member which appears to interfinger with the upper Regina Member, and (4) the youngest (sand and silt dominated) Tapicitos Member. Presented here are N=4 new detrital zircon samples (representing a total of n=769 new U-Pb detrital zircon ages) from each member of the San Jose Formation.

The basal Cuba Mesa Member of the San Jose Formation contains primary peak ages at 1693, 158, and 111 Ma, with secondary peaks at 1406, 231, and 188 Ma. The overlying Regina Member contains peak ages at 1689 and 185 Ma with secondary peaks at 1404 and 86 Ma. The Llaves Member has one primary peak age at 1708 Ma and secondary peaks at 162 and 96 Ma. The Tapicitos Member has primary peak ages at 1702, 163, and 66 Ma with secondary peaks at 1426 and 205 Ma. In addition to the peak ages in the Llaves and Tapicitos Member, these units also contain occurrences of ages that fall between 650-225 and 1200-1000 Ma. Zircons of this age were not present in the lower two members of the San Jose (Cuba Mesa and Regina Members). The youngest ages in all four samples from the San Jose fall between 95-65 Ma.

Detrital zircon ages that fall between 1700-1400 Ma overlap in age with the Mazatzal and Granite-Rhyolite Precambrian provinces and may represent detritus derived from local Laramide uplifts. Mesozoic ages (225-65 Ma) overlap with the Cordilleran arc and likely are recycled. Ages that fall between 1200-1000 Ma overlap with the Grenville province and are likely recycled from parts of the Sevier fold/thrust belt and Mogollon highlands. Although preliminary, U-Pb detrital zircon data from the San Jose Formation support a model where the basal Cuba Mesa and Regina members were derived largely from nearby basement Laramide uplifts, whereas the overlying Llaves and Tapicitos members were derived from these same Laramide uplifts as well as highlands in the Sevier fold/thrust belt and Mogollon highlands.

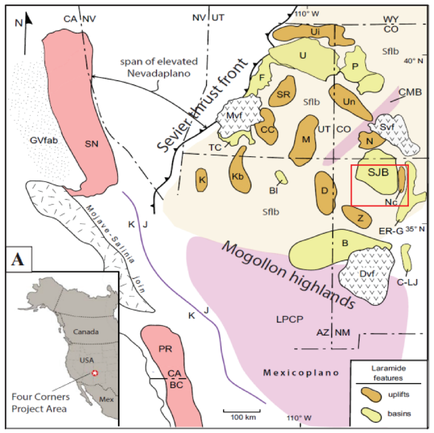


FIGURE 1. Generalized tectonic map of the Southwestern U.S. with Laramide uplifts and adjacent basins near the Four Corners Region (Modified from Pecha et al, 2018). The focus of this study is on the latest Paleocene-early Eocene strata in the San Juan Basin (SJB) depicted by the red rectangle. Note Laramide structures directly adjacent to the SJB include the Nacimiento (Nc), Zuni (Z), Defiance (D) and Needle Mountain (N) uplifts.

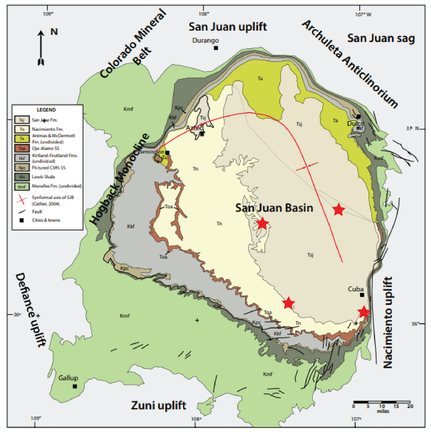


Figure 2. Generalized geologic map of the San Juan Basin in northwestern New Mexico. The Focus of this study is on the San Jose Formation (Tsj) which crops out along the southern margin of the basin (modified from Pecha et al., 2018). Red stars denote the four field localities of sample collection.

(2) STRATIGRAPHIC OVERVIEW - EOCENE SAN JOSE FM.

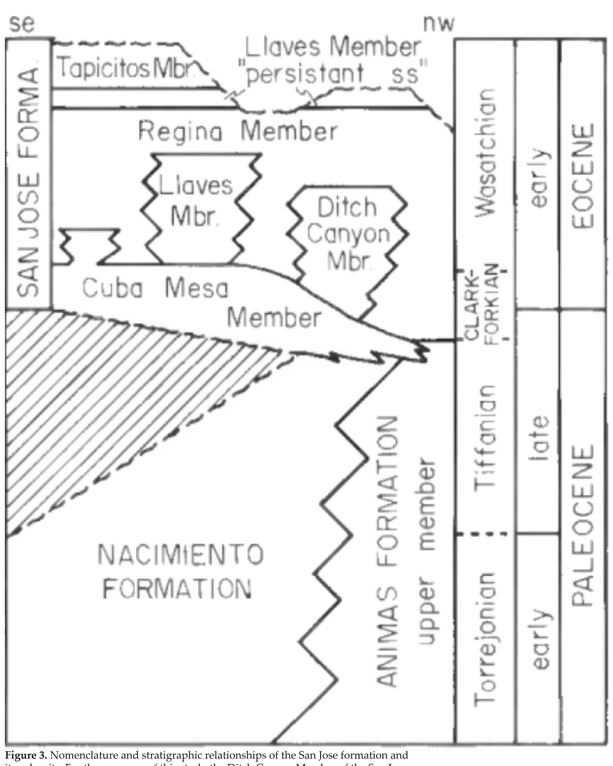
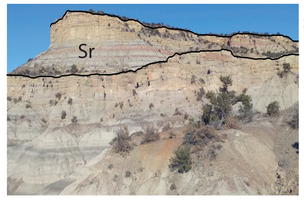


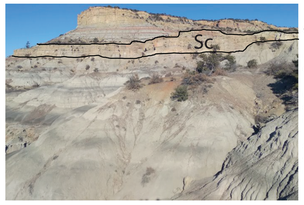
Figure 3. Nomenclature and stratigraphic relationships of the San Jose formation and its subunits. For the purposes of this study the Ditch Canyon Member of the San Jose is not sampled, as it does not occur in our current field area. (Smith, 1992)

Tapicitos Member: (St)
--The Tapicitos Member caps the high topography of the east-northeastern portions of the basin.
--Composed of red and tan sandstone with some mudstone lenses.

Llaves Member: (Sl)
-Llaves Member is made of thick beds of sheet sandstones that are red, yellow, and tan.
--Intertongues with the Regina in the east-central portion of the basin.



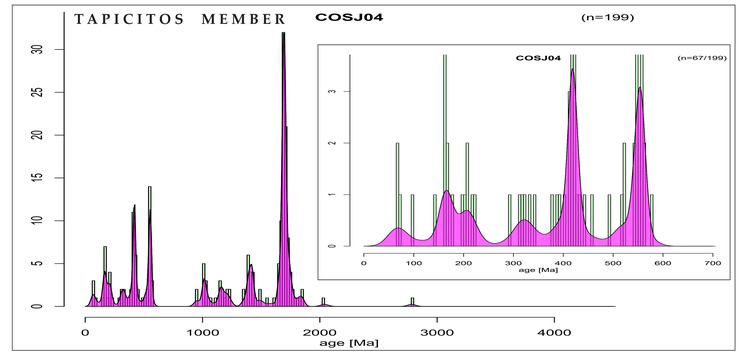
Regina Member: (Sr)
--Overlies and locally intertongues with the Cuba Mesa.
--Composed of sandy mudstone, with some fine to coarse-grained sandstone, and minor shale.
--Sandstone beds within the Regina Member are lenticular.
--Sandstone beds are cliff-forming units, while the mudstones form slopes.

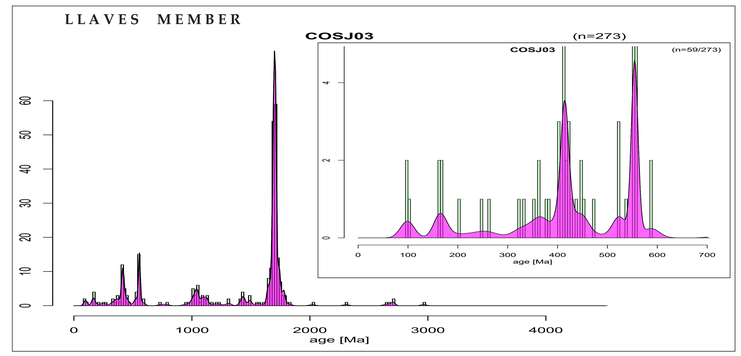


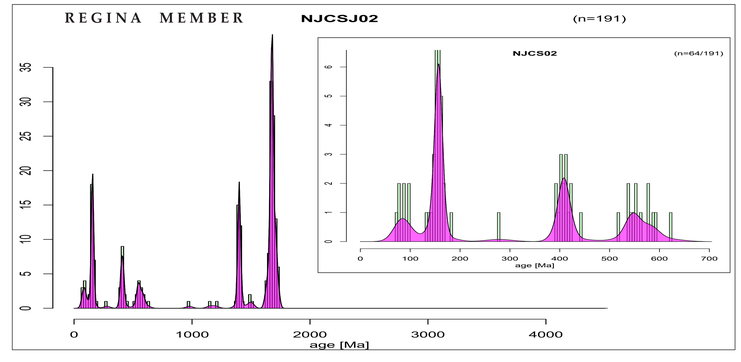
Cuba Mesa Member: (Sc)
--Yellow, blocky sandstones that range from fine-grained to coarse-grained.
--Pinches out centripetally toward the basin axis, and unconformably overlies the Nacimiento Formation in the south.
--Suggests a fluvial setting during early Eocene time, where there were several episodes of migration of the rivers from channel to floodplain.

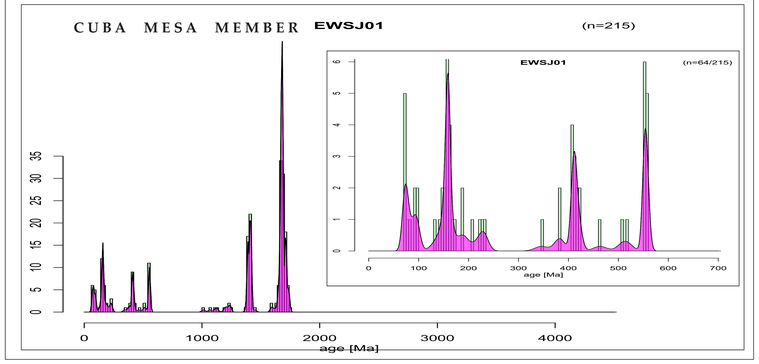
(3) U-PB DETRITAL ZIRCON DATA

SAN JOSE FORMATION









(4) SUMMARY & CONCLUSIONS

1. **Cuba Mesa Member:**
   - **Primary Peak ages at 1693, 158, 111 Ma**
   - **Secondary Peak ages at 1406, 231, 188 Ma**
   - **Likely derived largely from local basement Laramide uplifts**
2. **Regina Member**
   - **Primary Peak ages at 1689, 185 Ma**
   - **Secondary Peak ages at 1404, 86 Ma**
   - **Likely derived largely from local basement Laramide uplifts**
3. **Llaves Member**
   - **Primary Peak age at 1708 Ma**
   - **Secondary Peak ages at 162, 96 Ma**
   - **Likely derived from a combination of local basement Laramide uplifts, highlands in the Sevier fold/thrust belt, and Mogollon highlands**
4. **Tapacitos Member**
   - **Primary Peak ages at 1702, 163, 66 Ma**
   - **Secondary Peak ages at 1426, 205 Ma**
   - **Likely derived from a combination of local basement Laramide uplifts, highlands in the Sevier fold/thrust belt, and Mogollon highlands**

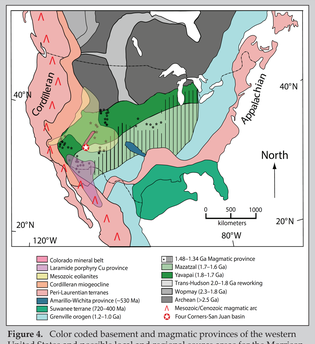


Figure 4. Color coded basement and magmatic provinces of the western United States and possible local and regional source areas for the Morrison Formation, Lytle Sandstone, and Dakota Group. Basement and magmatic provinces have been constrained by a number of previous studies (e.g., Hoffman, 1988; Laskowski et al., 2013; Gehrels et al., 2011). Location of Mesozoic eolianites from Leier & Gehrels, 2011. Figure from Pecha et al., 2018.

(5) REFERENCES & ACKNOWLEDGEMENTS

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