Introduction: NASA’s Perseverance Rover is exploring the Jezero Crater carrying the RIMFAX ground penetrating radar. RIMFAX has acquired a continuous subsurface radar image at 10 cm intervals along the rover’s > 25 km long ground track across the crater floor and fan, probing depths of >30 m below the rover, Figure 1. The Mars 2020 mission objectives are to seek signs of ancient life on Mars and cache a set of samples for possible return to Earth by a follow-on mission, [1]. An important part of the mission is to document the geological settings from which the cached samples are collected. RIMFAX provides subsurface context for better understanding the depositional environments of the geological units that the rover has examined thus far.

RIMFAX Ground Penetrating Radar: The Radar Imager of the Mars’ Subsurface Experiment is a gated FMCW radar operating in the frequency band of 150 – 1200 MHz. The antenna is a slotted bow tie antenna 60 cm above the surface. The typical center frequency of the reflected signal at 10–15-meter depth is 400 MHz. RIMFAX collects soundings in three operating modes (surface, shallow and deep) every 10 cm along the rover’s traverse path, [1].

Màaz Séítah Contact: The radar image reveals the presence of ubiquitous strongly reflecting layered sequences that dip downward at angles of up to 15 degrees from horizontal in directions normal to the curvilinear boundary of and away from the exposed section of the Séítah formation, Figure 2A. The observed slopes, thicknesses, and internal morphology of the inclined stratigraphic sections can be interpreted either as magmatic layering formed in a differentiated igneous body or as sedimentary layering commonly formed in aqueous environments on Earth.

Crater Floor Delta Contact: At the boundary between the Jezero Crater floor and the fan, RIMFAX detects a distinct discontinuity in subsurface layer structure, Figure 2B. The observed subsurface layering relationships are interpreted to demonstrate the presence of an angular unconformity at the base of the fan, reflecting erosion of the crater floor prior to the deposition of younger horizontally stratified sedimentary beds in the lower fan, [4].

Margin Unit: RIMFAX images reveal unusually deep penetration in the Margin Unit, approaching 35 meters below the surface in some areas. RIMFAX observes several strong dipping layers that become horizontal at depth that resemble deltaic cliniforms, Figure 2C. Between the strong reflectors are weaker reflectors.

**Figure 1.** Orbital context maps of the RIMFAX observations in Jezero Crater. Orbital High Resolution Imaging Science Experiment (HiRISE) color base map showing the path (pale white lines) of the Perseverance rover across the crater floor and delta front through Sol 1100. The red rectangles show the areas highlighted in this abstract.
Geological Modeling: The RIMFAX data can be used in conjunction with surface topography to make 3D models of the subsurface by picking the locations and depths of subsurface layers and inputting them into the GemPy structural geomodeling package [5]. GemPy using a universal cokriging interpolation method that allows the generation of complex 3D structural geological models through the interpolation of layer interfaces and orientation measurements and topography. Figure 3 shows a 3D view of a structural geomodel of the Marginal Unit based on RIMFAX data.

Acknowledgments: The data used in this work are available at the NASA PDS Geosciences Node (https://doi.org/10.17189/1522644). This work was supported by the Research Council of Norway, grant no. 309835 and by NASA.

References: