Re-adjusting paleodrainage in the Surat Basin infill from new data

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ABSTRACT
Just recently the release of more than 6000 wells in the public domain has provided an opportunity to re-draft the thickness distribution of formations within the Surat Basin, from both conventional and unconventional targets. This study examines on previous work from the eastern margin by Sliwa and Esteller [2018] to the whole of Surat Basin. The output is an integrated regional geological model of the Surat Basin interpreted from public domain data, including petroleum well and waterbore data, published maps, seismic data and regional magnetic and gravity datasets. The integration of image and acoustic data enriches the paleodrainage information detecting different flow vectors and direction through stratigraphic intervals.

The 3D model was built from a consistent correlation of formation tops and core well packages (Sliwa, 2018; Bianchi et al., 2020; Zhou unpublished) using wireline log data from petroleum and water wells. Wireline logs were normalised to the same API range for interpretation of lithologies, and in some units wireline motif was used to further define depositional elements (primary channel-thalweg and point bars, floodplain, and rises). Formation and sandstone thickness maps for twelve subbasin formations present in the Surat Basin show their relationship with the structural setting resulting in the formation of certain paleodrainage. The switching of palaeodrainage direction in different formations is an expression of a basin scale tilting.

INTRODUCTION
The Jurassic Surat Basin is partly located above the Permo-Triassic Bowen Basin and the metamorphic basement. The basin stratigraphic units used in this study are shown in the figure to the right. The slickensides derived from original basin faults have an expression on the Moonie-Goodwind Fault in the Surat Basin sedimentary succession. Recently, the effect of a far-field subduction takes over the original intracratonic sag basin theory. These effects are consistent with a dynamic tilting of the platform creating dynamic topography with alternation of subsidence and uplift pulses expressed by internal basin wide unconformities, such as the Springbrook unconformity (Bianchi et al., 2020). Studies by Farrant and Totten (2009) and others (Raza et al., 2010; Westbach, 2010; Hamilton et al., 2014) support this hypothesis, which involve the far-field effect of subduction-related dynamic tilting.

SOURCES DATA
Public domain data were compiled and quality controlled
- 2408 wells with digital lithology data;
- Wireline log data;
- Selected seismic lines for structural interpretation;

Paleocurrent direction from image logs
Springbrook Sandstone: 30 wells were interpreted; Wallon CN: 16 wells were interpreted; Hutton Sandstone: 6 wells were interpreted; Precipice Sandstone: 2 wells interpreted plus outcrop information.

MAPS
- Unit thickness was contoured for all the units in the Surat Basin based on the horizons from the OGA model.
- Sandstone thickness was contoured for all units in the Surat Basin based on the calculated sandstone thickness at boreholes

RESULTS
Thicker depocentres aligned with the Moonie-Goodwind Fault with trend NW-SE in the eastern part of the basin, in all formations from Precipice to Springbrook

CONCLUSIONS:
The depocentres changed in trend and position through the stratigraphy of the Surat Basin, in particular they changed from the basal Precipice to the Springbrook Sandstone. The depocentres are aligned with the eastern flank of the basin, probably due to the subtle activity of the Moonie-Goodwind Fault system. The Upper Precipice, Evergreen and Hutton show a tendency of the drainage to bifurcate as they have flow vectors northward and southward, possibly due to some dynamic platform tilting. Above every regional unconformity (Precipice and Springbrook), the trend is more clear and has a solid direction. In the Westbourne and Gubberamunda formation the depocentre distribution is located in the middle of the basin, without a particular trend, however, the data are not as well distributed.

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