Exploration implications of the Samo-1 Well, The Gambia

Occasional short releases by First Exchange Corporation on the MSGBC Basin #8
November 2018

It is often impossible for outsiders to reliably deduce why a well, such as Samo-1, failed as the subsequent press releases rarely mention the failure reason or reasons. In this case, given FEC's prior knowledge of the MSGBC Basin and informative pre-well press releases from FAR, plus the availability of a new GEO ExPro paper, meaningful observations can be made. This note presents these reasons and examines their implications as regards future prospectivity to the east in The Gambia (prospectivity to the west remains unchanged, subject to the comment regarding charge volumes in the next and finals paragraphs).

The well is reported to have encountered '*excellent quality reservoir'* and *'oil shows at several levels'*. This result carries with it the immediate implication that there was an oil charge, but that it was not trapped. However, there is an alternative possibility which is that there was only a part charge to the structure. This possibility is not considered likely since we have predicted from our own work that the mid-Cretaceous and Jurassic source successions are mature down dip in blocks A1 and A4. Also, nearby and on trend, SNE works, as does the FAN structure. Maturity levels west of the carbonate bank drop to the south and lack of a Cretaceous sourced charge cannot be discounter as the cause of the dry hole: for the operator the geochemical analysis of the shows will be crucial in determining the validity of this possibility. Pivotal will be the maturity of the oils. Provided the charge volume in Samo-1 was sufficient or more than sufficient, prospectivity to the west will remain unchanged, subject though to reservoir development. Information is available on source rocks and their maturity in FEC's 2016 Senegal report.

Three reasons for trap failure could exist at Samo-1. The first is that there was no side seal against the highest structure on trend, SNE (Figure 1).

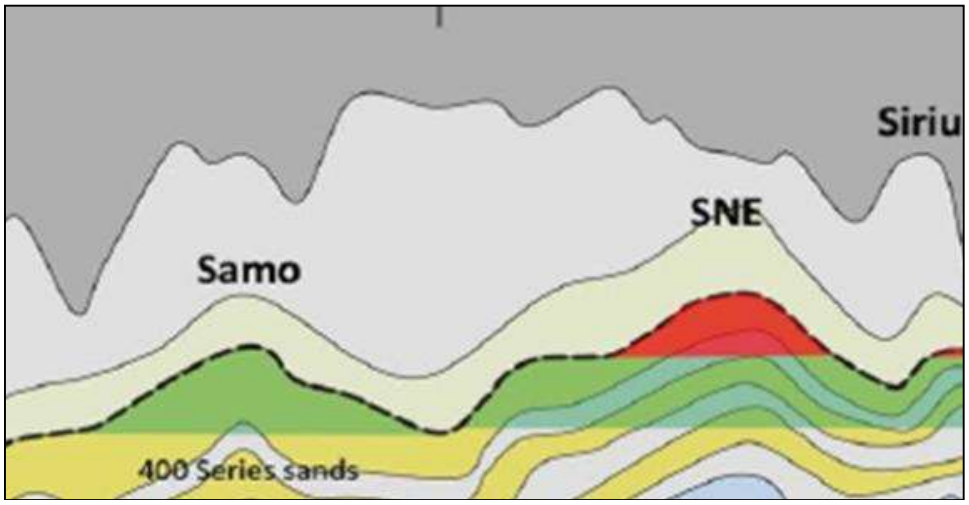

Figure 1. Samo to SNE strike profile (north is to the right).

The SNE reservoirs accumulated in pro-delta settings and at Samo in delta top facies (Figure 2). Figure 1 confirms that facies could differ as the 400 series sands thicken towards Samo-1.

SNE's sands being reworked should be cleaner than those updip within the delta. However as previously noted, Samo reservoir quality is reported to be excellent. Top seal should be more reliable at SNE as clay depositing, highstand influences are normally stronger in off delta settings. SNE's size may be limited by the possibility that hydrocarbons could leak laterally eastwards into the rising delta front as illustrated in Figure 3. It is unknown whether the SNE closure is fully charged.

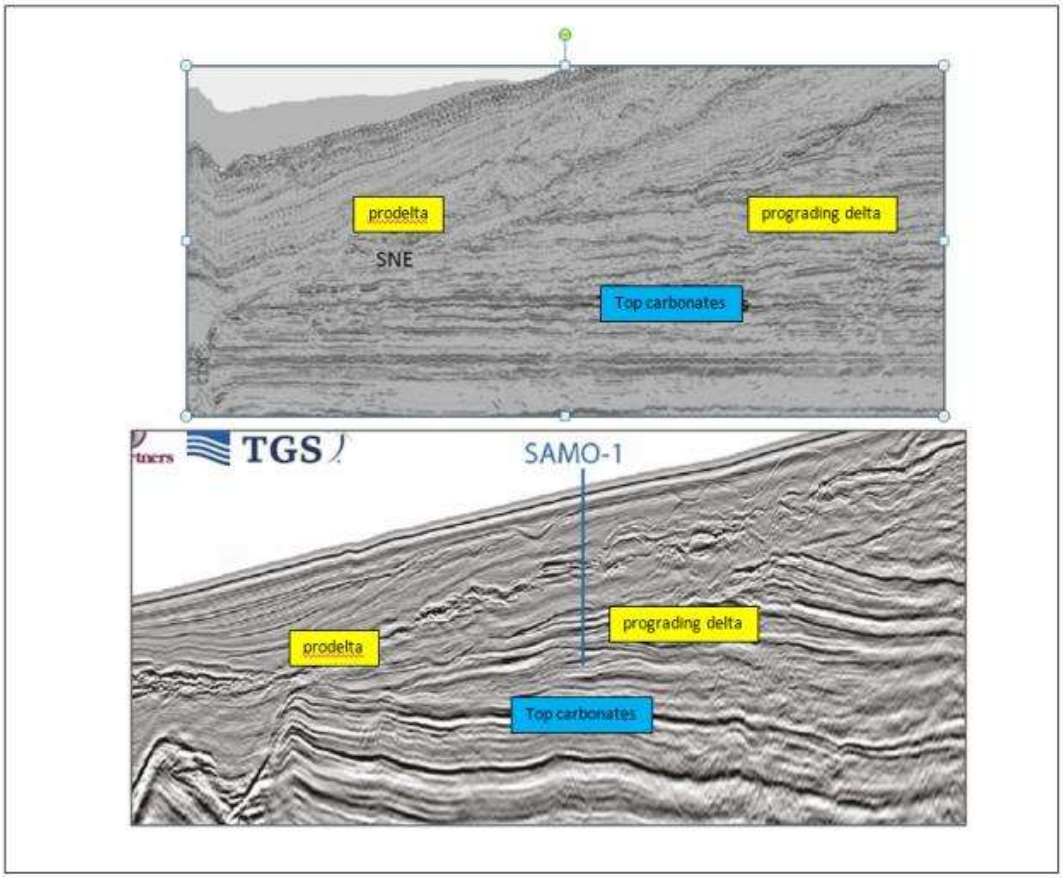

Figure 2. Dip sections for SNE and Samo-1.
The top profile is flattened in time within in the top carbonates,
the second profile was supplied in depth.
The horizontal scales are unknown.

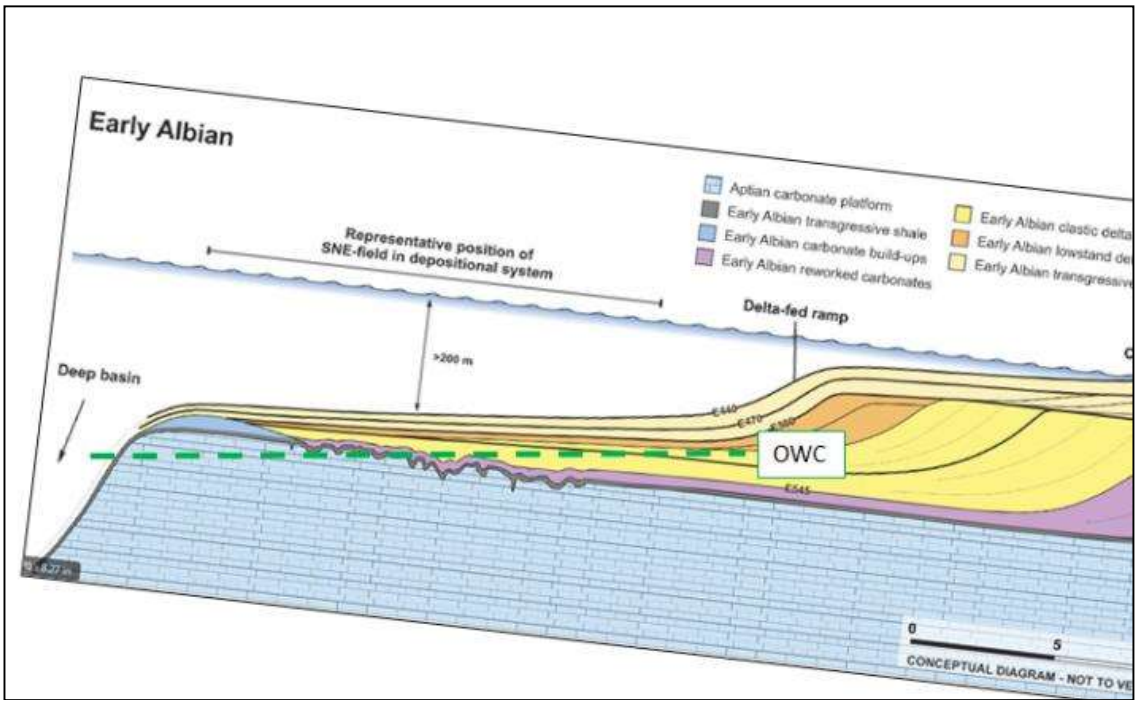

Figure 3. An eastern limit to the size of SNE-1.
A deeper OWC would require stratigraphic control
of the trap to the east or allow new eastern accumulations.

With its higher sand N:G, lateral seals will be more tenuous within the delta and it may be that the charge at Samo-1 has drained away eastwards. This is the second possible cause of trap failure. Prospectivity along the delta trend is not dependent on SNE settings; but requires a sufficient charge and a trap. This means that Samo delta top settings can still work, subject to the final trap control which is examined in the next paragraph.

The third possibility is that top seal was breached by downcutting channels associated with the Santonian Break (Figure 4, this break is labelled PMU on the profile). This is the most likely possibility since 3D and SNE well control is available for the strike section which means Figure 1 should be reliable. Presumably there were hydrocarbon interpreted amplitudes at Samo-1 (these would now be related to the residual charge). Thief beds were a recognised risk before SNE-1 was drilled. Their likelihood at SNE is all too apparent on Figure 2: strike sections display multiple downcutting canyons.

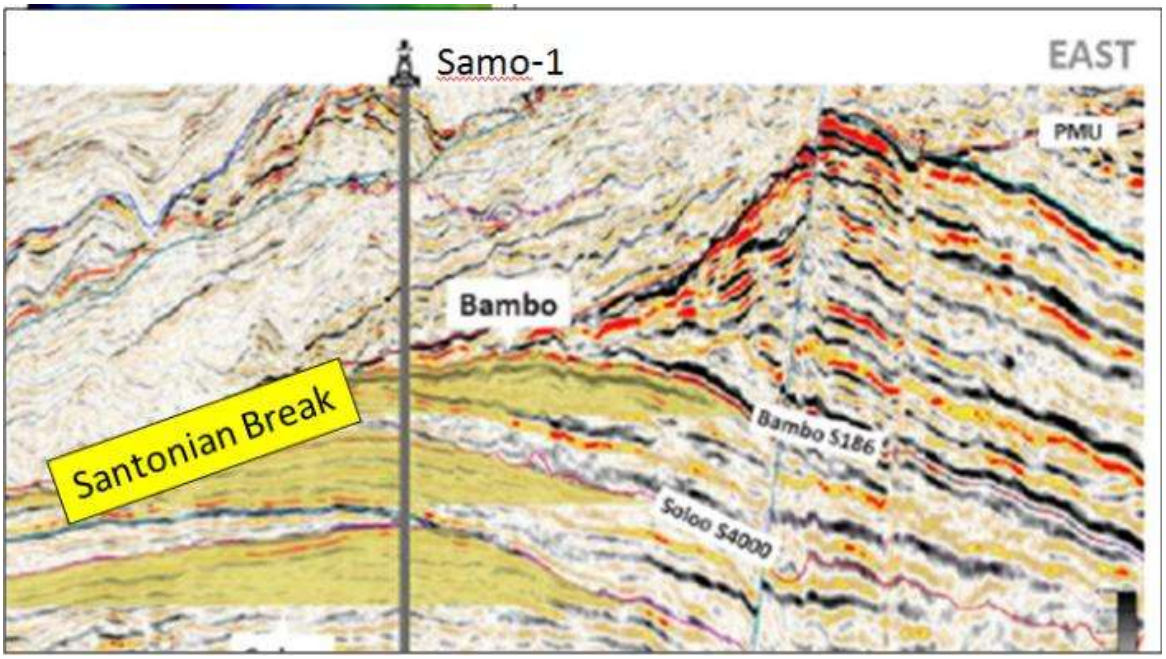

Figure 4. Samo-1 dip profile.
Thief beds could be hosted within the post-Santonian Break or PMU downlaps.

There was a methane peak just above the Santonian Break in the Jammah-1 wells (well data are available from FEC), but this could be the product of early in-situ generation rather than the result of thief bed migration. However, the post-Break cover fabric is characterised by off-shelf progrades analogous to those present in Samo-1 (Figure 5). The gas log and cuttings geochemistry from Samo-1 should provide the answer for the operator (isotope cross plots would supply information on the gas maturities).

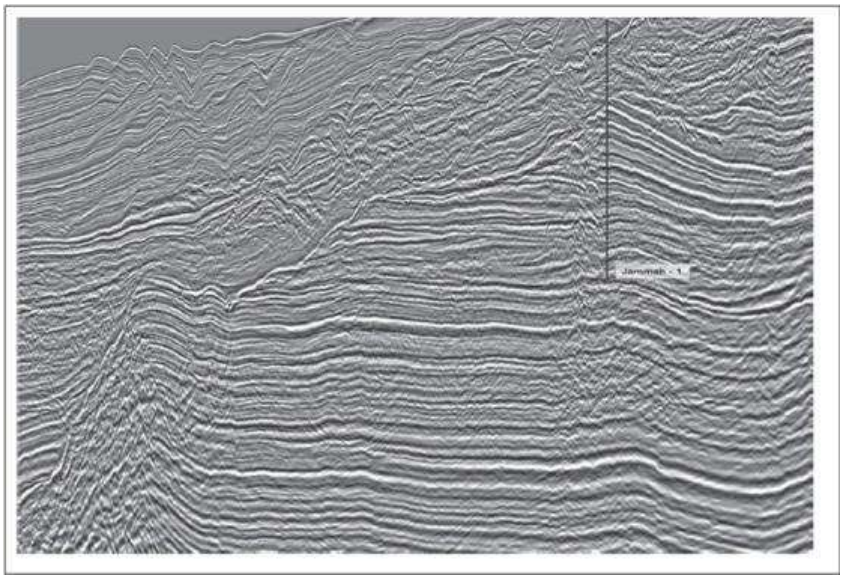

Figure 5. Jammah-1 dip section.
This image comes from the 2017 Spectrum paper mentioned below.

If the failure of Samo-1 is purely related to leakage into SNE, not much can be done to rescue the Samo trend, though the closures mapped by FAR in blocks A5 and A6 may still be prospective (Figure 6), provided there is top and side seal. Other requirements are downdip source maturities, plus hydrocarbon migration routes.

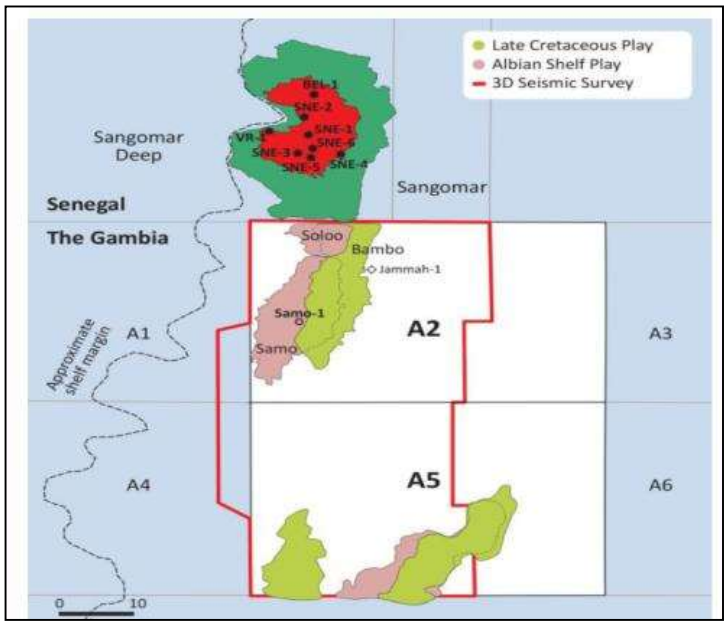

Figure 6. Possibly still valid structures in southern blocks A5 and A6.

If the main failure cause is either lateral leakage within the delta or vertical leakage by way of thief beds into the younger Cretaceous, significant, shallow target opportunities could exist in blocks A3 and A5, plus further to the east, provided there is top seal (Figure 7). Gas and/or oil would be targets.

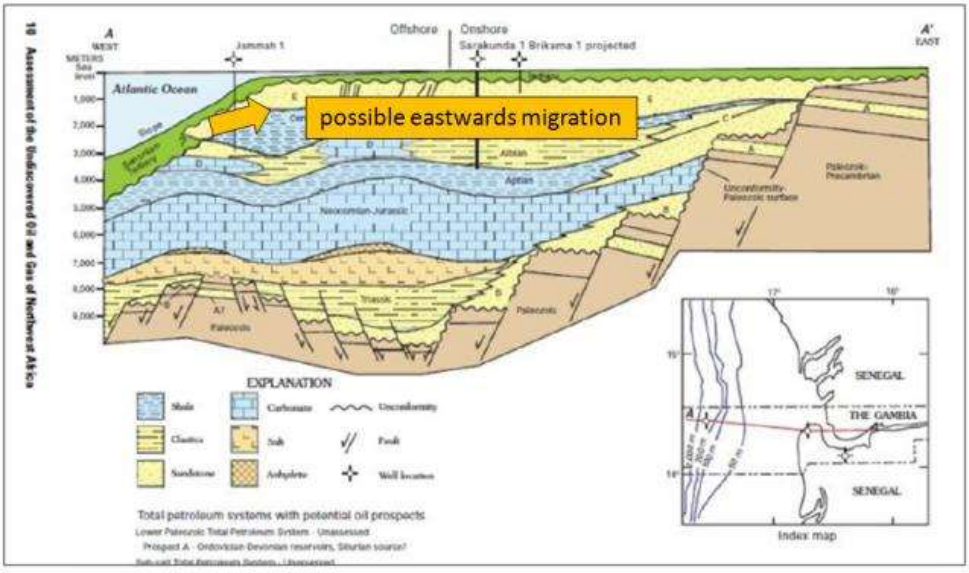

Figure 7. Dip geoseismic profile indicating possible shallow onshore and nearshore opportunities.

Onshore Jurassic targets may also emerge given FEC's work on Jurassic sources. This possibility will become more important if the mid-Cretaceous migration volume into Samo-1 does prove to have been too low.

Please contact FEC should further information be required relating to this occasional release or their reports on the MSGBC Basin. Their Contact details are:

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