A REGIONAL CHEMOSTRATIGRAPHICALLY-DEFINED CORRELATION FRAMEWORK FOR THE LATE TRIASSIC TAG-I FORMATION IN BLOCKS 402 AND 405A, ALGERIA

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ABSTRACT: The Triassic Argilo-Gréseux Inférieur Formation (TAG-I) is one of the principal hydrocarbon reservoirs in the Berkine Basin of Algeria. Sedimentological studies have shown that it exhibits marked spatial and temporal facies variations on both a local field scale and regional basinal scale. This variability, combined with a lack of diagnostic flora and fauna, make regional correlation of the unit difficult. In turn, the lack of a consistent regional stratigraphic framework hampers the comparison of the various correlation schemes devised by operators in the basin.

Contrasting the TAG-I in blocks 402 and 405a exemplifies the problems encountered when attempting regionally to define a correlation framework for the interval. Between these two blocks, a distance of approximately 200km, there are marked changes in the style of deposition from sand-dominated, proximal fluvial systems in the SW (Block 405a, MLN, MLC and MLW fields) to a more distal, more clay prone system in the NE (Block 402, ROD/BRSE/BSFN, SFNE and BSF fields). A chemostratigraphic study of the TAG-I in these two blocks has allowed a four-fold correlation framework to be defined. Each chemostratigraphic package is geochemically distinctive, with the geochemical variations being due to changes in detrital mineralogy of the sandstones and changes in clay mineralogy of the claystones. Each of the chemostratigraphic packages is bounded by a geochemically recognisable and regionally significant stratigraphic surface. By combining the geochemical differentiation of the units and recognition of their stratal boundaries, it is possible to define a correlation for the TAG-I between blocks 402 and 405a.

The proposed correlation between the two blocks suggests that, the northern parts of Block 405a may have been occupied by a spur or subsidiary channel from the main SW to NE trending fluvial system, resulting in one of the chemically defined packages being demonstrably absent in the MLNW, MLN, KMD and MLC fields when compared to the other areas of the study.

KEY WORDS: Chemostratigraphy, Lithostratigraphy, TAG-I, Fluvial, Sedimentology, Fluvio-lacustrine

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INTRODUCTION

Triassic sandstones of the Berkine Basin in Algeria (which include the late Triassic Argilo-Gréseux Inférieur Formation, or TAG-I) are a prolific hydrocarbon reservoir that is part of a SW to NE trending fluvio-lacustrine depositional system, extending eastwards from Algeria through southern Tunisia (Figure 1). A summary of the regional setting of Triassic sequences in the Berkine Basin is presented by Busson (1971a, b) and an overview of Palaeozoic petroleum systems by Boote et al (1998). More detailed lithostratigraphy and sedimentology of the TAG-I Formation are given by Turner et al. (2001).

In blocks 405a and 402, the TAG-I thickness varies from 25m to 100m, where it displays lateral and vertical facies variations on a local and regional scale. In Block 405a (which includes the MLNW, MLN, KMD and MLC fields), the TAG-I has a high net to gross ratio and is dominated by sheet flood and braided, low-sinuosity fluvial deposits, with laterally persistent sandstones and claystones. In Block 402 (which includes the ROD/BRSE/BSFN, SFNE and BSF fields), the net to gross ratio is markedly lower, typically with low
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Sinuosity fluvial deposits and occasional higher sinuosity fluvial channel sandstones and relatively thick claystone intervals (Figure 1). In each block, the respective joint ventures have erected detailed stratigraphic zonation schemes that are valid within their field areas (figures 2 and 3). However, a lack of diagnostic fauna or flora from the well-bore samples and the lateral changes in facies between the two study areas, makes relating the stratigraphic schemes proposed for blocks 405a and 402 problematic. Seismic resolution is also insufficient to aid with regional correlations. This paper demonstrates how the technique of chemostratigraphy enables the TAG-I in blocks 405a and 402 to be correlated and thereby defines a working regional stratigraphic framework for the TAG-I.

**Figure 1:** Location map and stratigraphic summary. The inset in the bottom right shows the approximate extent of the Berkine Basin in Algeria and Tunisia and also indicates the area covered by the larger map. On the main map, the oil fields that form part of this study are marked in green and the wells used to define the regional correlation are marked. Gamma traces for the study intervals in selected wells are displayed to demonstrate the change from sand-prone to more clay-prone facies in Blocks 405a and 402 respectively. A stratigraphic summary is inserted in the upper right of the main map.

Chemostratigraphy, or chemical stratigraphy, involves the characterisation and correlation of strata using major and trace element geochemistry. For this study, data for a total of 47 elements (10 major elements (Al₂O₃, SiO₂, TiO₂, Fe₂O₃, MnO, CaO, MgO, K₂O, Na₂O and P₂O₅), 23 trace elements (Ba, Be, Co, Cr, Cs, Cu, Ga, Hf, Mo, Ni, Nb, P, Rb, Sc, Sn, Sr, Ta, Th, U, V, Y, Zn and Zr) and 14 rare earth elements (La, Ce, Nd, Pr, Sm, Eu, Gd, Tb, Tm, Dy, Ho, Er, Yb and Lu)) have been determined using inductively coupled plasma optical emission spectrometry and inductively coupled plasma mass spectrometry. The sample
preparation and analytical procedures used in this study are the same as those detailed in Jarvis and Jarvis (1995), Pearce et al. (1999a) and summarized in Pearce et al. (2005b). The study incorporates data from over 1200 conventional core samples from 35 wells in blocks 402 and 405a.
Chemostratigraphy, as with most stratigraphic techniques, is a subjective and interpretative technique. In any rock section, even within a single stratigraphic unit, the large number of variables that potentially affect the elemental concentrations means that not all samples will fall within the “typical” geochemical signature defined for that unit. This is exacerbated when samples from core, due to inhomogeneities occurring on all scales. In cuttings samples a certain degree of homogenization occurs due to the nature of drilling and cuttings mixing on their retrieval. Therefore, in any chemostratigraphic study, a sufficiently large dataset, such as that acquired for this paper, is required to negate any “flyers” in the data. Additionally, samples from a unit that plot outside the typical field for that stratigraphic interval on graphical plots may need to be disregarded for the characterisation.

Sequences throughout the stratigraphic column and from many of the world’s hydrocarbon provinces have been analysed using chemostratigraphy (Ehrenberg & Siring 1992, Racey et al. 1995, Preston et al. 1998, Pearce et al. 1999a, 1999b, 2004, Wray 1999, Craigie et al. 2001, Pearce et al. 2003, Ratcliffe et al. 2004, Pearce et al. 2005a, Pearce et al. 2005b). Although the technique is used widely in the oil industry, the majority of studies are proprietary and results remain unpublished. This paper represents one of the first attempts to use the technique as a correlation tool to define major chemostratigraphic packages that can be recognized over a distance of 200km in a regional continental setting.

STUDY SEQUENCE

In the study area, the TAG-I rests unconformably on a subcrop of Carboniferous to Devonian sediments and is overlain by the Triassic Argilo-Carbonaté (or Triassic Carbonates) (Figure 1). The sedimentology of the TAG-I has been described by Turner et al. (2001) to be a series of predominantly fluvio-lacustrine facies that is overlain by the estuarine to shallow marine Triassic Carbonates. Turner et al. (2001) describe a total of 23 lithofacies based on core descriptions, with the principal facies associations in the Block 402 area consisting of fluvial channel sandstones, floodplain siltstones and palaeosols, crevasse splay deposits, lacustrine sediments and shallow marine transgressive deposits.

Regionally, the internal lithostratigraphy of the TAG-I is complicated, although locally it can be layer cake in nature. While the apparent complexity is, in part, inherent in a fluvial system with a wide variety of facies associations, it is exaggerated in the case of the TAG-I due to the lack of a regional stratigraphic framework that can be used to define. Licences and field areas shown in figure 1 are operated by a number of different oil companies each having its preferred stratigraphic framework that has been internally devised. This makes stratigraphic comparisons between blocks difficult. As demonstrated in this paper, chemostratigraphy can be used to define the principal stratigraphic building blocks of the TAG-I on a regional scale.

Turner et al. (2001) presented a semi-regional correlation of the TAG-I based on core descriptions, mineralogical data and wireline log responses. Their published study, however, concentrated on the area associated with blocks 401 and 402 and did not extend into Block 405a, where the TAG-I facies distributions are notably different. They did demonstrate that the TAG-I thickens and becomes more sandy to the SW. The chemostratigraphic correlation framework proposed here compliments and in most cases confirms the stratigraphy presented by Turner et al. (2001), extending it into Block 405a and thereby defining a stratigraphic framework that can be applied in both the sand prone proximal and more clay-prone distal settings.

CHEMOSTRATIGRAPHIC ZONATION

Four chemostratigraphic units, namely (in ascending order) CP1, CP2, CP3 and CP4, are defined for the TAG-I from blocks 402 and 405a. Each of the units has internally consistent geochemical features that allow them to be differentiated from one another. Additionally, each unit is bounded by regionally identifiable surfaces, whereby allowing correlation between the two blocks in question. The main geochemical features of blocks 405a and 402 are shown on figures 2 and 3 respectively. Figure 2 uses the well MLN-1 as a chemostratigraphic template for wells in Blocks 405a and figure 3 uses the well BSFN-1 for wells in Block 402. The main mineralogical features that are interpreted to affect the geochemistry in the two areas are displayed on figures 4 and 5.

ZONE CP1

CP1 is the oldest TAG-I interval identified and is separated from the underlying Palaeozoic sediments by the Hercynian Unconformity. In Block 402, CP1 is composed of thinly bedded sandstones and silty claystones (e.g. BSFN-1, Figure 3), whereas in Block 405a, the unit comprises a basal sandstone that can be 12m thick overlain by a claystone over 10m thick (e.g. MLN-1, Figure 2). Despite this lateral variation between the two blocks, both the claystones and sandstones of CP1 can be geochemically differentiated from those in the overlying units. In Block 402, this unit is equivalent to Sequence 1 of Turner et al. (2001) who describe the top of their Sequence 1 to be a
regional disconformity in block 402, with the sequence consisting of an infill of the inherited post-Hercynian Unconformity topography relief.

The sandstones of CP1 are generally differentiated geochemically from those of CP3 and CP4 by their low K₂O/Al₂O₃ and high Zr/Nb ratios (figures 2 and 3). The notable exception to this is the lower sandstones in several wells from the MLN Field (e.g. MLN-1 on figure 2), where K₂O/Al₂O₃ values are similar to those higher in the study. These lower sandstones contain dark grey mudstone rip-up clasts that are responsible for locally increasing the K₂O/Al₂O₃. The sandstones of CP1 are geochemically similar to those of CP2. Petrographic data indicate that the sandstones of CP1 are relatively kaolinitic probably due to K feldspars having been degraded, which probably contributes to the low K₂O/Al₂O₃ values in the sandstones of CP1. The relatively high Zr/Nb ratio values in the sandstones are shown, by heavy mineral analysis, to reflect high zircon/rutile ratios when compared to the younger sandstones (figure 4).

The claystones of CP1 are geochemically differentiated from those above by their low K₂O/Al₂O₃ values and high Al₂O₃/(CaO+MgO+Na₂O+K₂O) values. XRD analyses demonstrate that the low K₂O/Al₂O₃ values are reflecting the high kaolinite contents of CP1 claystones compared to those within the overlying chemostratigraphic packages (figures 4 and 5).

The top of CP1 is coincident with the disconformity surface described in Block 402 by Turner et al. (2001). The geochemical features below this surface are typical of a pedogenically altered and highly weathered surface. The Al₂O₃/(CaO+MgO+Na₂O+K₂O) ratios in the claystones immediately below the disconformity are markedly high (c.6-8) when compared to the claystones 5-10m below, where the values are typically less than 3 (figures 4 and 5). This is typical of palaeosol development as described by Retallack (1997) and by Pearce et al. (2005a). Additionally, the TiO₂/K₂O in the claystones immediately below, or close to the disconformity surface are markedly high. This ratio reflects high anatase content (Figure 4) in the relatively K₂O-depleted pedogenically altered, kaolinitic claystones. The geochemical features of this surface are readily recognised in blocks 402 and 405a, where they are used to define the disconformity surface and thereby regionally constrain CP1.

**ZONE CP2**

In Block 402, CP2 is directly equivalent to Sequence 2 defined by Turner et al. (2001). It comprises mostly claystones with relatively thin (<1m) sandstones that overly the pedogenically
altered claystones at the top of CP1. CP2 is shown below not to be recognised in the MLNW, MLN, KMD and MLC fields of Block 405a.

The sandstones of CP2 have K<sub>2</sub>O/Al<sub>2</sub>O<sub>3</sub> values that are marginally higher than those of CP1 and markedly lower than those of the overlying sandstones (Figure 3). Petrographically, the sandstones of CP2 show no evidence for feldspar dissolution and yet contain markedly less feldspar than those of the overlying units. This indicates that a major influx of feldspar occurred between deposition of CP2 and CP3. Turner et al. (2001) describe a mineralogical break at their Sequence 2 / Sequence 3 boundary where there is marked influx of feldspar that indicates a change in sediment provenance to a more feldspathic-rich lithology. This change in mineralogy is clearly geochemically modelled using K<sub>2</sub>O/Al<sub>2</sub>O<sub>3</sub> values. The Zr/Nb values in CP2 sandstones of Block 402 are high compared to those of CP3, but are similar to those of CP1 in Block 405a. This suggests that the heavy mineral composition of CP1 is similar to CP2, but is different to that of CP3, further suggesting a change in sediment provenance prior to the onset of CP3 deposition.

The claystones of CP2 are differentiated from those below by their higher and upwardly increasing K<sub>2</sub>O/Al<sub>2</sub>O<sub>3</sub> values, but lower and upwardly decreasing Al<sub>2</sub>O<sub>3</sub> / (CaO+MgO+K<sub>2</sub>O+Na<sub>2</sub>O) values (figures 3 and 5). They are differentiated from the overlying claystones by their high Zr/Nb values, mimicking the changes seen in the sandstones.

In the north of Block 405a, (MLNW, MLN, KMD and MLC fields), sandstones that lie immediately on top of the geochemically defined disconformity surface contain abundant feldspar, resulting in high K<sub>2</sub>O/Al<sub>2</sub>O<sub>3</sub> values. The sandstones also have low Zr/Nb values, making them geochemically similar to CP3, which is described below (i.e. these sandstones postdate the change in sediment provenance inferred from the geochemical data at the CP2 / CP3 boundary in Block 402). Therefore, the chemostratigraphic data indicate that CP2 is absent from wells in the northern Block 405a fields. The absence of CP2 sandstones is demonstrated graphically in figure 6, where ternary diagrams for sandstone data in selected wells, show that no sandstones with CP2 geochemical compositions are present in wells MLN-1 and MLC-1. The unit can also be similarly

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**Figure 5.** Summary of mineralogical data (whole rock XRD data, clay fraction XRD data and detrital mineralogy determined from petrographic analyses) acquired from wells BSFN-1 and ROD 8 in Block 402. The wireline log displayed is that of well BSFN-1. The position of the samples from ROD 8 have been placed in their correct stratigraphic position based on the proposed chemostratigraphic correlation framework.
shown to be absent from all study wells in the MLNW, MLN and MLC fields. In the south of Block 405a, where the MLSE Field (Figure 1) occurs, the geochemical data from this area indicates the reappearance of the CP2 unit (Figure 6).

The relatively thick CP1 sequence in the northern Block 405a fields and the lack of evidence in core for extensive erosion at the top of the CP1 unit in these fields implies that absence of CP2 is due to non-deposition, rather than erosion. This is supported by the presence of a palaeosol horizon at the top of unit CP1 in these fields, which may be the time equivalent of CP2. The non-deposition could be attributed to a lack of accommodation space, which in turn suggests that the base level rise that allowed deposition of CP2 in Block 402 (and the MLSE area of Block 405a) did not affect the area of the MLNW, MLN, KMD and MLC fields. However, Turner et al. (2001), postulate that during deposition of their Sequences 2 and 3 (units CP2 and CP3 in this paper), the main fluvial fairway ran SW to NE, but that there were a series of spurs trending to the ENE and E. These spurs entered the main fluvial fairway tangentially to the main sedimentary depositional axis. It is therefore suggested here, that the area of the northern Block 405a fields occupied one such spur during deposition of CP2 in the main fluvial fairway. Switching of fluvial drainage to another channel complex could have resulted in the non-deposition recorded in this area of Block 405a.

**ZONE CP3**

CP3 in Block 402 is lithologically variable, comprising a mixture of fluvial sandstones interspersed with overbank and lacustrine claystones. In Block 405a, however, it is composed mostly of a 5-12m thick sandstone unit that is capped by a fining upward sequence culminating in black shales (Figure 1).

The sandstones of CP3 have higher $\frac{K_2O}{Al_2O_3}$ values than those of CP2, but lower values than those of CP4 (Figure 3). Petrography shows that this change in $\frac{K_2O}{Al_2O_3}$ values is directly related to the feldspar content of the sandstones, which reaches a maximum in CP4 (figures 4 and 5).

The claystones of CP3 are differentiated from those of CP2 and CP1 by their high $\frac{K_2O}{Al_2O_3}$ values, which are shown to reflect their more illitic nature (figures 4 and 5). The claystones of CP3 are, however, geochemically similar to those of CP4. Although claystones of CP3 and CP4 are difficult to differentiate chemically, the contact between the two units is clearly marked by claystones with high $\frac{MgO}{Al_2O_3}$ values (Figure 3), which is shown from core inspection to represent the development of a dolcrete in Block 402. In Block 405a, the claystone at the top of CP3 has high $\frac{MgO}{Al_2O_3}$ values.

**Figure 6.** Ternary diagrams constructed from sandstone data in selected wells. These diagrams show that sandstones with geochemical composition of CP2 are absent from wells MLN-1 and MLC-1. Selected wells. These diagrams show that sandstones with geochemical composition of CP2 are absent from wells MLN-1 and MLC-1.
relative to others in the TAG-I (Figure 2), but not as high as those of the dolcretes in Block 402. In cores from Block 405a, dolcretes at this horizon are not described. However, the claystone that has elevated MgO/Al2O3 values in Block 405a is a very dark grey to black shale and has high illite contents (Figure 4). The high illite contents are weakly reflected by the relatively high K2O/Al2O3 values in this claystone (Figure 2), but the marked change in clay mineralogy is masked by the high K-feldspar contents in this part of the TAG-I. The presence of the dolcrete and illitic black shale at the CP3 / CP4 boundary implies a prolonged and laterally pervasive period of lacustrine deposition, which suggests that the boundary is coincident with the Sequence 3a / Sequence 3b boundary as defined by Turner et al. (2001) in blocks 401 and 402.

ZONE CP4

In most wells, CP4 is composed of a 4-8m thick sandstone that fines upwards into a claystone. However, several wells, notably BSFN-1 in Block 402 have only limited sandstone development in this unit. In Block 405a, the fining upward sandstone typical of unit CP4, is occasionally overlain by a 2-8m thick sandstone with a blocky gamma-ray log motif (e.g. MLN-1, figure 1). This sandstone is sufficiently geochemical different to those below that CP4 is further subdivided into CP4a and CP4b (figure 2) in Block 405a.

The sandstones of CP4a have the highest K2O/Al2O3 values in the study interval, which is petrographically shown to reflect high potassic feldspar contents (figures 4 and 5). The sandstones of CP4b have lower K2O/Al2O3 values, but higher Zr/Nb values when compared to those of CP4a (figure 2). Respectively, these geochemical features are due to lower K feldspar, but higher zircon values of this sandstone. The sandstone associated with units CP4a and CP4b are interpreted to be late stage, meandering fluvial system whose main provenance was older TAG-I sediments. Reworked older TAG-I sediments in these sandstones, explains the decreased amount of the relatively unstable feldspar (lower K2O/Al2O3 values) and higher concentrations of the more stable zircon grains (higher Zr/Nb values). The occurrence of meandering fluvial sandstones at the top of the TAG-I in Block 405a may indicate a rise in base level associated with the on set of transgression from the northeast.

As discussed above, there are no clear and systematic geochemical characteristics that allow the claystones of this unit to be differentiated from those of CP3. Further, because of the meandering nature of the CP4a and CP4b sandstones, some well penetrations in Block 405a have encountered no CP4 sandstone deposition. Thus CP3 claystones are overlain by relatively thick sequences of CP4 claystones making exact correlation problematic.

Top TAG-I

Chemostratigraphically, the top of CP4 unit corresponds to the top of the TAG-I. In blocks 401 and 402, Turner et al. (2001) place the top TAG-I (top Sequence 3) at a transgressive surface of erosion that comprises a lag deposit containing intraclasts and bone/fish fragments. This is often capped by a thin waxy black shale that contains bivalves. Geochemically, this lag can be identified in Block 402 by its high P and Mg contents (e.g. ROD-8) and is therefore taken as the chemostratigraphic top of the TAG-I. However, in Block 405a no such lag has been recorded from cored intervals, making definition of the formation top more problematic. This is further complicated when deposition of meandering fluvial sandstones of CP4 does not occur, resulting in the TAG-I / Triassic Carbonates formation boundary being a claystone on claystone contact. Geochemically, in Block 402, a local Rb/K2O minimum is ubiquitously recorded at the transgressive lag surface that marks the top of the TAG-I. A similar Rb/K2O minimum is recorded at or close to the topmost sandstone in wells from Block 405a. In this block, this R/K2O feature is commonly coincident with an upward increase in Zr x Hf / Al2O3 values. The Zr x Hf / Al2O3 ratio is a sensitive indicator of the amount of silt grade zircon grains present in the claystone and its decrease at the top of CP4 reflects a decrease in terrestrial sediment supply, such as may be expected in association with a transgressive event (i.e. the transgressive lag in Block 402). Therefore, the Rb/K2O minimum and upward decrease in Zr x Hf / Al2O3 values are correlated with the transgressive lag in Block 402 and are therefore taken to be the regional marker for the top of the TAG-I.

CONCLUSION

Chemostratigraphy is used to define four units (CP1-4), each of which has internally consistent geochemical compositions. Geochemical variations in the sandstones are related to changes in detrital mineralogy and provenance, while those in the claystones are interpreted to be due to a mixture of changes in detrital composition and changes in the degree and type of syn-depositional weathering. The bounding surfaces of each chemostratigraphic package are related to regionally definable events:

• Base CP1 boundary (base TAG-I) is the regional Hercynian Unconformity, which has been associated with a
number of tectonic events (Hercynian/Variscan orogenies) that have affected the Sahara craton (Boote et al 1998).

• CP1 / CP2 boundary is a regional disconformity at which marked pedogenesis has occurred, indicating a period of non-deposition within the TAG-I. It appears to have affected large areas of the Berkine Basin and is suggested here, to be a significant break in sediment transport into the study area.

• CP2 / CP3 boundary is a major change in sediment mineralogy that is probably provenance related, due to un-roofing, possibly, of an acidic igneous complex of the hinterland. This again implies either localised tectonic activity in the source/provenance area or major changes in the drainage patterns feeding the axial braided river system.

• CP3 / CP4 boundary is a period of regional lacustrine deposition (i.e. a decrease in sand input) probably caused by a reduction in basin profile and/or stream bypass (to the southeast of the study area). However, punctuation by occasional rejuvenation events is observed, with sand being deposited in meandering fluvial stream channels.

• Top CP4 boundary (top TAG-I) is a basin-wide transgressive event from the northeast, with evidence of increased marine influence in that direction.

By enabling differentiation of each unit and identifying their bounding surfaces, chemostratigraphy allows wells in blocks 402 and 405a to be correlated (figure 7). The proposed correlation suggests:

• The total TAG-I thickness is greater towards the NE than in the SW, but localised thickness variations can occur between relatively closely spaced areas such as the MLN and MLC fields (figure 7). This in part is due to localised thickening when crossing a major bounding fault that displays strike slip as well as vertical movements. This fault complex forms the main bounding fault not only for Block 405a fields but also migrates north-eastwards towards the giant Ourhoud Field of Block 404 and 406.

• CP1 is generally thicker in the MLN and MLC fields compared to the southeastern MLSE Field of Block 405a and the ROD fields within Block 402.

• CP2 is absent from the MLN and MLC fields, which results in the hiatus disconformity surface that marks the top of CP1, being coincident with the mineralogical break that marks the CP2 / CP3 contact in the MLSE Field and Block 402 area.

• The distribution of CP2 suggests that the central Block 405a area (MLNW, MLN, KMD and MLC fields) may have occupied a different valley system to that in which the TAG-I of the MLSE Field and Block 402 fields were deposited.

• CP3 and CP4 are present in both blocks and while CP3 appears to be of relatively uniform thickness, CP4 appears to thin eastwards and southwards from the central parts of the MLN Field.

To conclude, it has been shown here that chemostratigraphy can provide a working framework for the comparison of lithostratigraphic schemes devised for different TAG-I sections in different parts of the Berkine Basin by different field operators. The Basal TAG-I in Block 402 has been proved to be equivalent to the Lower TAG-I in Block 405a. CP2 is the Lower TAG-I in Block 402 and from the geochemical fingerprints of different wells over the study area, is clearly absent from some field areas in Block 405a. The Middle and Upper TAG-I of Blocks 402 and 405a are equivalent to one another and are assigned to CP3 and CP4 respectively. It is therefore important not only to analyse sandstone but also claystone samples, since both are required to build up the correlative framework. This is particularly important where sandstone deposition is replaced by claystone sequences related to floodplain sedimentation or periods of non-deposition and pedogenic development.
**Figure 7.** Correlation of selected wells in Block 402 and 405a. The wells selected for this diagram typify the wells of Blocks 402 and 405a.

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