Zeitschrift: Bulletin für angewandte Geologie

Herausgeber: Schweizerische Vereinigung der Petroleum-Geologen und –Ingenieure; Schweizerische Fachgruppe für Ingenieur-Geologie

Band: 4 (1999)

Heft: [1]: Geological results of a hydrocarbon exploration campaign in the southern Upper Rhine Graben

Artikel: Geological results of a hydrocarbon exploration campaign in the southern Upper Rhine Graben (Alsace Centrale, France)

Autor: [s.n.]

Kapitel: 2: Summary and results of the Shell-SNEA(P)'s exploration activities 1970-1990

DOI: https://doi.org/10.5169/seals-221515

Mulhouse, Séléstat, and Strasbourg (Zorn) depressions (hatched area in Fig. 2). Wherever the mature source rock and the Triassic reservoirs were juxtaposed by major faults, hydrocarbons would be able to migrate into the stratigraphically older reservoirs; the structural relation between Triassic hydrocarbon accumulations and the presumed Toarcian source rock in the Greater Pechelbronn area was taken as a model (Schnæbelé 1948: Plate IX (section 4); Blumenrœder 1962: Fig. 12). Fault throws needed to juxtapose the Lower and Middle Triassic reservoirs with the Toarcian source rock, would be some 550 m and 300 m, respectively.
In the Sundgau area, south of Mulhouse, a possibly source-rock-bearing Permo-Carboniferous trough or graben was expected to be present between the well Wintersingen (some 20 km E of Basel), which had drilled oil-shale-bearing Autunian, and the outcropping Stephanian coal measures, mined in the Ronchamp area on the SW slope of the Vosges. Further north, the occurrence of Late Paleozoic source rocks was regarded less likely, except possibly in a NE-trending belt crossing the Rhinegraben between Séléstat and Offenburg, connecting scattered occurrences of Late Paleozoic strata west and east of the Rhine Graben (Fluck & Weil 1975: Fig. 26). In the Vosges (Fluck in BRGM 1972b: 6-7, 24, 32-36), isolated patches of Westphalian west of St. Hyppolyte (6 km SW of Séléstat) contain uraniferous bituminous shales (0-50 m thick) and coal lenses; while Stephanian and Autunian coal was mined near Villé at the edges of the Permian Villé Basin. Here, as in the Permo-Carboniferous trough of northern Switzerland, the faulted Autunian is overstepped by less deformed Saxonian strata, thus recording the so-called Saalian movements. Comparable and possibly related occurrences of Lower Permian to Upper Carboniferous strata are found in the Black Forest near Offenburg (anthracite-bearing Westphalian of Diersburg-Berghaupten, and Stephanian of the Geroldseck near Lahr) and near Baden-Baden (Geyer & Gwinner 1991: 49).
Minor source rocks were assumed to exist in the Lettenkohle and the Lower Muschelkalk.

Traps were expected to resemble known structural traps like Staffelfelden in the south, and Eschau, near Strasbourg, in the north: These comprise eastward-tilted fault blocks, bounded by major antithetic faults in the west, and dip-bounded in the east (Blumenrœder 1962: Fig. 14, 18).

Blumenrœder (1962: 43) had discerned in the area of interest two regional highs, the „dorsale de Colmar-Gerstheim" and the „seuil d'Erstein" which he assumed to have been positive features at the beginning of the Tertiary deposition. As a rule, oil accumulations in Mesozoic reservoirs in the Alsace had been found in structures, that existed already in or before early Tertiary time (Blumenrœder 1962: 45), so these two highs, and in particular the hardly investigated Colmar-Gerstheim swell, were regarded as particularly prospective.

2. Summary and results of Shell-SNEA(P)'s exploration activities 1970-1990

In order to explore the play described, Shell Française applied in 1970 for large permits in the southern and central part of the Alsace, and SNEA(P) in the central and

[1] 1^G = 1 gon = 100` = 0.9°; on French official maps, geographical coordinates are given in gons, with the Paris Meridian as origin for longitudes

northern part. Subsequently, both companies decided to join forces in the central area between the latitudes of Guebwiller (S. of Colmar) and Marmoutier (NW of Strasbourg) called „Périmètre d'Association Shell-ERAP 'Alsace Centrale'", Shell Française being operator south of 53G 60` N1 (just south of Séléstat) and SNEA(P) north of that line (Fig. 2).
In 1974, the well Meistratzheim-2 was drilled by Shell Française (in compensation of earlier activities of SNEA(P) within the northern part of the jointly explored area) on a well defined high where an earlier well had found good oil and gas shows in the Grande Oolithe. The new well confirmed the presence of thick, porous and permeable sandstone reservoirs in the Buntsandstein, but failed to find any hydrocarbons in the Triassic.

Between 1974 and 1980 the Association then acquired some 1200 km of seismic lines. This permitted to study the structural style of the entire jointly explored area and the delineation of the structural pattern of both the Tertiary and the Mesozoic formations.

Five more wells were drilled in the period 1978-1980, two in the north, adjacent to the Schæffersheim gas field south of Strasbourg, and three in the south, between Colmar and the Kaiserstuhl. None of them encountered any hydrocarbons in the Triassic. Only one, Artzenheim-1, encountered significant oil shows, but no reservoir, in the higher part of the Grande Oolithe (see chap. 3.2.3).

A critical review of this first drilling campaign showed that:

- the Triassic reservoirs drilled were essentially devoid of hydrocarbons. This could mean that the charge mechanism envisaged -migration from the L. Jurassic source rock in a low block into juxtaposed Triassic reservoirs of the high block- did not work (although fault throws appeared to be sufficient), or that insufficient hydrocarbons had been generated to charge the Triassic reservoirs;
- whereas one of the expected source rocks, the Toarcian bituminous shales, proved to be regionally present, no indications for Late Paleozoic deposits were seen between Strasbourg and Mulhouse, in either wells or in the seismic records;
- the reservoir quality of the Grande Oolithe proved (as expected) to be highly variable; and in the southern wells much poorer than in the north (MEI-2);
- the increasing thickness of Paleogene salt towards the Mulhouse Potash Basin led to the formation of salt ridges on top of, and triggered by, faults in the Mesozoic-basal Tertiary substrate;
- the definition of trap geometry proved difficult due to rapid lateral variations of sound velocity, and to the difficulty, if not impossibility of correctly migrating the 2D-seismic lines in areas of intense faulting and salt tectonics; and most important of all,
- the southern part of the Rhine Graben had limited hydrocarbon generation potential. Hydrocarbon kitchens appeared to be restricted to the deepest parts of the Potash Basin and its SW continuation (Dannemarie Graben). There was apparently no Recent widespread hydrocarbon generation, and long range migration did not appear to occur.

In consequence, interest became focussed on traps *within* the assumed kitchens, with the Grande Oolithe as the main objective - notwithstanding its highly variable reservoir properties. The Association therefore applied for, and was awarded in 1979 and 1987, respectively, the permits „Neuf-Brisach" and „Munchhouse" adja-

cent to the old acreage and covering the deepest part of the graben east and south of Colmar (Fig. 2). The old permits covering the Colmar-Gerstheim Swell were allowed to expire.
Seismic surveys in the new permits confirmed the presence of large, N-S trending tilted blocks below a thick, halotectonically deformed Tertiary overburden. A well, Ste-Croix-en-Plaine-101 D (deviated as SCR-101 G) was drilled in 1989 in the deep Mulhouse Salt Basin SSE of Colmar on the culmination of a tilted block with access to a deep kitchen. The Grande Oolithe, the prime target, was, however, not encountered, probably due to fault cut-out. The well also failed to find any hydrocarbons in the deeper reservoirs of the Lettenkohle-U. Muschelkalk, and the Buntsandstein. The Association therefore decided to terminate the exploration activities in the area. Twenty years after Shell Française's first application, the last two permits were allowed to lapse at the end of their respective periods of validity in 1990.

3. Interpretation of seismic and well data (by area)

3.1 Strasbourg - Séléstat area

3.1.1 Operational aspects

The area discussed (Fig. 5) comprised the SNEA(P)-operated part of the „Périmètre d'Association" between Lat. 53^{G}60` (just S of Séléstat) and 54$^{G}$10` (see chap. 2). Nearby hydrocarbon accumulations and indications in the Mesozoic reservoirs (Triassic and Dogger) appeared to confirm the play concept: Mesozoic (Jurassic and Triassic) reservoirs were present, and migration of hydrocarbons from potential Toarcian source rock into the reservoirs across antithetic faults appeared possible where source rock and reservoir were juxtaposed.

Within the area, SNEA(P)'s Schæffersheim Field is located (with producible gas, and oil shows in the Grande Oolithe). In the Meistratzheim-1 well (MEI-1), good oil and gas shows were encountered. Oil shows were also reported in the Sundhouse area E of Séléstat, from shallow water wells and the well Sundhouse-P1 (SHP-1; Gachot 1936).
3 km NE of the permit, an oil accumulation in the Grande Oolithe had been found in the Eschau structure, an eastward tilted block, bounded in the west by an antithetic fault (Blumenrœder 1962: Fig. 7, 8). Eschau-1 (PREPA[1]1955) drilled 40 m into the Buntsandstein, and tested 13 m3/h salt water with gas shows.
7 km W of Eschau, the well Lipsheim-1 (LIP; PREPA 1957) had tested within the permit a similar structure, but found only oil shows in the Grande Oolithe.
On the Wittisheim structure, some 14 km NE of Colmar, PREPA had drilled the well Wittisheim-1 (WIS) to the Grande Oolithe in 1955 (BRGM 1972b: 38, 40), but tested only salt water.

After preliminary studies, exploration activity in the permits of the Association started in this northern part, where Shell Française drilled in 1974 the well Meistratzheim-2 (MEI-2), based on seismic acquired before by ERAP. Later on, the Association acquired more than 700 km of new seismic lines in the area and drilled two more wells, Grunsbuhl-1 (GRB, Fig. 5) and Binnenweg-1 (BWG, Fig. 5), in 1979.

[1] Societé de prospection et exploitations pétrolières en Alsace