Pau Research Center
S.N.P.A.
Pau France

# APPENDIX NO. III

## LABORATORY RESULTS OF KEEP RIVER NO. 1

# A. LITHOSTRATIGRAPHY

## 1. Lithostratigraphic Zonation

| Depth | Lithostratigraphy | Presumed Age |
|---|---|---|
| 0-1550' | Kulshill Formation | Lower Permian |
| 1600-2450' | Tanmurra Formation | Lower Carboniferous |
| 2500-9570' | Milligan Formation<br>Member 1:2500-2900'<br>Member 2:2950-3700'<br>Member 3:3750-6120'<br>Member 4:6150-9570' | |
| 9600-10650' | Septimus Formation | |
| 10680-11350' | Enga Formation | |
| 11380-11710' | Burt Range Formation | |
| 11740-12190' | Unnamed Formation | Lower Carboniferous to Upper Devonian |
| 12220-15510' | Ningbing Limestone Formation | Upper Devonian |
| 15540-15623' T.D. | Cockatoo Formation ? | |

## 2. Description of Lithostratigraphic Assemblages

### 2.1. 0' to 1550' - Kulshill Formation (in cuttings)

- some sandstones or argillaceous greywackes, locally quartzitic,
- some coarse quartz grains and rock fragments (quartzite, chert, large feldspars) evidently derived from the dis-aggregation of sandstone or greywackes
- some siltstone grading to very fine, micaceous, lignitic sandstone,
- some silty to finely sandy shales, micaceous and lignitic. Minor amounts of sparite cemented sandstones and quartzitic sandstones are present.

Lignitic debris and pyrite are sometimes abundant. Feldspar is present throughout, almost entirely orthoclase.

The top of the section suggests a lateritic surface on the presence of rubefied sandstone and shale. The base (1500'-1550') shows a much coarser granulometry with abundant large quartz grains, microcline and quartzite fragments.

These microfacies correspond to the Lower Permian, recognised in other wells in the Bonaparte Gulf Basin as belonging to the Kulshill Formation. It is not possible to define with which member of this formation they can be correlated.

2.2. 1600' - 2450' - Tanmurra Formation

The Tanmurra Formation is clearly marked from 1600' by the appearance of:

- micrite grading to microsparite occasionally silty to finely sandy with rare organic debris, (thin-test type Ostracods and possible spicules) concentrated notably at the top of the formation.

- dolomicrosparite grading to dolosparite (occasionally calcareous) sandy, grading in turn to sandstones with dolomicrosparite and dolosparite cement.

To these new and characteristic microfacies of the formation may be added:

- fine to medium, occasionally coarse-grained, subangular to subround grained sandstone; locally to rarely clay and carbonate cemented, weakly glauconitic, with rare quartzite and chert pebbles.
- sparite cemented sandstones, locally quartzitic.
- clay or clay-carbonate cemented sandstones, locally quartzitic.

Intermediate variants of these three types of sandstones exist.

Also represented are intercalations of silty shale rich in mica (muscovite, decoloured biotite, rare chlorite) lignitic debris and pyrite.

Feldspars are present throughout, represented by microclines.

The Tanmurra Formation is distinguished from the underlying Milligan Formation by the former's sandier character and coarser granulometry.

2.3. 2500' - 9510' - Milligan Formation

As in Kulshill No. 1 and Bonaparte No. 1 the Milligan Formation can be subdivied into four members.

23.1 2500'-2900' Member 1

Below 2500' to the base of the formation appeared the following typical microfacies

-Silty, micaceous (muscovite, biotite and chlorite) shale with lignite debris and pyrite.

-Siltstone grading to very fine grained sandstone, micaceous, lignitic, pyritic.

-Argillaceous sandstone, very fine to fine grained, micaceous, lignitic, pyritic.

All the gradations between these three types can be seen in microfacies They appear to be formed of rhythmic, flysch type deposits on the grain size of the detritic elements.

The dolomicrosparite - cemented sandstones and micrites characteristic of the Tanmurra Formation are still present but in lesser quantity and may be largely due to caving, as is the case in the vicinity of 2700'.

Among the feldspars, orthoclases are progressively replaced by plagioclase, these last being exclusive lower in the sequence. Siderite occurs throughout the Milligan Formation.

23.2 2950' - 3700' - Member 2

The microfacies of this member are identical with those of Member 1, but show a clear predominance of shaly facies and a correspondingly distinct decrease in the granulometry of the quartz

23.3 3750' - 6120' - Member 3

This member is distinguished from the preceding member by its slightly sandier character, coarser granulometry and the presences of organic debris (essentially Echinoderm and Mollusc fragments).

In addition to the microfacies characteristic of members 1 and 2, sparite cemented sandstone also occurs. A coarser and sandier passage was found between 3850' and 3900'.

23.4. 6150' - 9570' Member 4

Member 4 is marked by the appearance of quartzitic sandstones in addition to the previously described microfacies. These sandstones locally have a clay or clay-carbonate cement and can grade to a locally quartzitic, sparite cemented sandstone.

The granulometry becomes increasingly coarser.

The shales appear occasionally microconglomeratic with coarse quartz grains or scattered quartzite.

Rare intercalations of sandy biosparite and fossiliferous sandstone with sparite cement occur. These become characteristic of the underlying formation.

Among the rare organic debris, occur Echinoderms and Lamellibranchs as well as very rare Ostracods, Tetrataxis (at 6440').Productid spines, Calcispheres, Koninckopora macropora (at 7490' and core 7) have been recognised. The sediments of this member can show oblique stratification.

The base of the member, from approximately 8520', becomes poorer in quartzitic sadnstones, while the sandy biosparites although rare, are present throughout. This gives a transition zone between the Milligan Formation and the underlying Septimus Formation.

2.4. 9600' - 10650' - Septimus Formation

This formation is clearly shown by the marked increase in sandy biosparite and fossiliferous, sparite cemented sandstones which appeared in Member 4 of the Milligan Formation. These microfacies are characteristic of the Septimus Formation in outcrop. Organic debris is very abundant in the carbonate facies, dominantly Echinoderms, with lesser Molluscs (chiefly Lamellibranchs), Brachiopods, and more rarely Bryozoa. Ostracods, Crytophyllus and Productid spines. This organic debris is often slightly rounded and covered by a film of clay. Ooliths occur as dispersed individuals and isolated pockets.

The shales associated with this carbonate facies are in general very dark (rich in organic matter?) and pyritic. They can also be rich in organic debris similar to that of the sandy biosparites. The debris is isolated in the shale, either as pockets or discontinuous beds associated with coarse quartz. Polished surfaces can be seen at the scale of thin sections.

The base of this formation, below 10320', is markedly poorer in sandy biosparites and richer in shale with isolated organic debris. The interval 10320' to 10650' could perhaps be attached to the underlying Enga Formation; however its fossiliferous character and the fact that it is sandy only after 10680' leads us to include it in the Septimus Formation. There is perhaps a transition zone between the two.

### 2.5. 10680' - 11350' Enga Formation

This formation is marked by the almost total disappearance of sandy biosparites and the appearance of sandy shale sediments typified in Core 14. These black, sandy shales with pyritic partings, slightly micaceous with disturbed bedding grade to fine sandstones with scattered coarse grains and a black shale cement. Locally these sandstones are slightly coarser and can become quartzitic.

Organic fragments are rare. They include Echinoderms, Molluscs and probable spicules. The spicules appear first in the shaly base of the Septimus Formation.

The base of this formation particularly below 11250' becomes much sandier and includes quartzitic and sparitic sandstones.

### 2.6. 11380' - 11710' - Burt Range Formation

Reappearance of sandy biosparites marks the entry into this formation. It is carbonate rich, with microfacies very similar to those of the Septimus Formation.

Also observed are occasional rare micrites or pelletal dismicrites.

The base (11620' - 11710') becomes sandier and quartzitic.

2.7. 11740' - 12190' - Unnamed Formation

A very shaly formation characterised by silty shale; micaceous, pyritic and thin bedded (cf. Core 16).

Organic debris is rare, including Echinoderms, Molluscs, Ostracods, Productid spines and Algae?

Also observed were rare micrites and dimicrites with encrusted debris, sometimes with partially or completely silicified oolites. These micrites and dismicrites can contain small neoformational quartz grains, less frequently, (at 12040') neoformational feldspar grains.

Situated between the Burt Range Formation and the Ningbing Limestone Formation, this formation has no equivalent knownto us elsewhere in the Bonaparte Gulf Basin. In addition it is not dated. We propose designating it provisionally under the term "Unnamed Formation".

2.8. 12220' - 15510' - Ningbing Limestone Formation

A calcareous formation with microfacies analogous to those found in outcrop samples in the Ningbing Region.

From the top to bottom the following succession can be distinguished.

28.1 12220' - 12490'

Predominantly dismicrite and Renalcis type biodismicrites with fragments of Molluscs, Echinoderms, Ostracods, Calcispheres, Irregularina and Girvanella.

This is typically found in Core 17, particularly at the top of that core, Some intraclasts and pellets were observed.

28.2 12520' - 13070'

Extremely recrystallised limestone including dismicrites, microsparites and sparites; apparently azoic with rare dolomitic passages.

Detritic quartz is practically absent but neoformational quartz is present, sometimes common. Core 18 shows macroscopically and in thin section structures closely resembling stromatactis.

It is also possible that these facies were rich in algal remains which have been erased by the recrystallisation.

28.3 13100' - 13340'

Appearance of azoic micrites or with rare fragments of Ostracods, Girvanella, Calcispehres, Molluscs; and intradismicrites, weakly fossiliferous (namely Echinoderms and Molluscs). Micrites are more common than intradismicrites.

Locally these micrites have undergone discrete dolomitisation (scattered crystals of dolomircrosparite od dolosparite), certain passages have been more completely dolomitised 13280' - 13340').

Quartz (detritic and neoformational)is present in small quantities throughout; sporadically more abundant (13250' - 13340')

28.4 13370' - 13910'

Intradismicrites become much more common with pelletoidal passages. Organic remains are somewhat more frequent with Echinoderms, Molluscs, Ostracods, Calcispheres, Foraminifera (Tournayellidea or Endthyridae), Irregularina, Solenopora and encrusting algae.

Quartz (detritic and neoformational)is present in small quantity throughout locally more abundant (cf Core 19).

28.5 13940' - 14370'

Intradismicrites are less frequent, being replaced by micrites and pelmicrites.

Organic remains are identical to those of the preceding interval.

Quartz becomes more common and is almost exclusively detrital.

Traces of muscovite are present throughout (cf Core 20)

Traces of dolomite were observed with thin black shaly and silty levels (organic matter?)

28.6 14400' - 14850'

There is no difference in microfacies with the preceding interval. Intraclasts are more abundant, quartzless commonly and delomitisation increases progressively(cf Core 21).

28.7 14880' - 15240'

Same microfacies as above but with a sharp increase in dolomitisation. Frequent dolosparites can be seen, particularly below 14970'(cf core 22).

28.8 15270' - 15510'

Dolomitisation is practially complete; only dolosparites and dolomicrosparites can be seen in which no organic remains are visible.

28.9 15540' - 15623' (T.D.) - Cockatoo Formation ?

A sandy formation characterised by the presence of very fine to fine quartzitic sandstone, feldspathic (orthoclase). Locally has dolomitic cement and rare mica (muscovite), (cf Cores 23, 24, 25).

The top (until 15600') appears richer in dolomite (silty to finely sandy dolomicrospartie or dolomicrite), with silty to shaly and micaceous levels (core 23). This could indicate a transition with the dolomitic basal Ningbing Limestone, or a per- decensum infiltration.

Note: Palynological studies give an Upper Devonian (Famennian) to Lower Carboniferous age ( Core 23). This datation in association with the sandy facies leads to the idea of its equivalence with the Cockatoo Formation. Certain analogies can be noted with the Cockatoo Formation in Bonaparte 1 and Kulshill 1. A difference exists nevertheless in its clearly quartzitic character in Keep River No. 1.

3. Clay Mineralogy

Clay mineral composition has allowed the distinction of four groups.

- the Kulshill and Tanmurra Formation with vermiculite, kaolinite, and illite and some chlorite
- The Milligan Formation with illite - montmorillonite, kaolinite and chlorite.
- The Septimus, Enga and Burt Range Formations with illite and chlorite.
- The Ningbing Limestone with illite.

3.1 Kulshill Formation and Tanmurra Formation

For each of these two formations the vertical distribution of the different clay minerals evokes a sedimentary sequence. Illite decreases from the base to the top while vermiculite is more common at the top.

The lithological differences between the two formations are marked also in the clay phase. In the illitic lower portion of the Kulshill Formation chlorite is found. Chlorites are absent in the Ranmurra Formation.

Finally in the upper half of the Kulshill Formation a greater proportion of kaolinite is present than in the Tanmurra Formation, and a kaolinite zone can be distinguished overlying a vermiculite zone.

The parallel evolution of these sediments shown in the distribution of clay minerals indicates perhaps a common source of detritic material for these two formations. The presence of chlorite and the greater percentage of kaolinite in the Kulshill formation indicates a greater degree of alteration of the material deposited in the Permian, in comparison with that of the Tanmurra Formation.

### 3.2 Milligan Formation

The three upper members of the Milligan Formation contain mainly illite-montmorillonite (70%). Proportions of kaolinite and chlorite are weak, Towards the base of Member 3, at 5950', the proportion of kaolinite reaches 30 to 40% and there is no more than 50 % of illite-montmorillonite. This composition continues untils 8500'. Below this level kaolinite diminishes progressively and is present sporadically at the base of Member 4.

### 3.3 Septimus Formation, Enga Formation, Burt Range Formation

Kaolinite is absent. The proportion of chlorite reaches 30 to 40 %. Illite-monmorillonite is replaced by illite.

### 3.4 Unnamed Formation, Ningbing Limestone

The clay phase is composed uniquely of illite in the levels which are more or less dolomitic. Where dolomite is absent, the presence of a little chlorite is possible .

The clay mineralogy of Keep River No. 1 is different from that of Bonapartes 1 and 2 where the Milligan Formation contains a great deal of kaolinite, a little montmorillonite and no chlorite. At Kulshill 1 there is no kaolinite in the Milligan formation, only illite-montmorillonite and chlorite. The clay mineral composition of Keep River is intermediate between that of the Bonaparte area and that of Kulshill.

## B. BIOSTRATIGRAPHY

### 1. Palynology

#### a. Introduction

The palynoplanctologic study of Keep River 1 (0' - 15623') has included

- 24 samples from cores
- 108 samples from cuttings

For cuttings the distribution of sampling has been as follows:

- between 0' and 100' one averaged sample of 40' each 200'
- between 1000' and 8000' one averaged sample of 40' each 100'.
- between 8000' and T.D. - one averaged sample of 40' each 200'.

Observations on the composition, percentage and preservation of the palynologic material are tabulated below.

| Levels | Composition | Quantity of Microfossils | Preservation |
|---|---|---|---|
| 0' to 240' | Sterile | | |
| 300' to 1540' | Saccate Pollens and Spores | Frequent to abundant | Good |
| 1600' to 1740' = cavings? | " | Minor (Cuttings) | Average |
| 1800' to 2100' | Spores | Variable; decreases with depth | Good at top Material very dark below 2500' |

#### b. Stratigraphic Results

Reminder

The results of the palynologic studies are expressed in APT units (Australian Permo-Triassic) and ADC units (Australian Devono-carboniferous). These units, defined from the wells of St. George 1, BMR 2, Bonaparte 1 and 2, Kulshill 1 and 2 characterise a stratigraphic sequence of which the latter units go from Famennian to Upper Carboniferous and the former from Permian to Triassic. It is probable that this scale will be revised in the future if new terms are defined (Lower Devonian or Upper Carboniferous).

In the light of present knowledge we assume the following correspondences:

7 - 9 APT = Triassic
5 - 6 APT = Upper Permian
1 - 4 APT = Lower Permian
6 ADC = Lower to Upper ? Carboniferous (Visean to Namurian)
3 - 5 ADC = Lower Carboniferous (Tournaisian to Visean)
1 - 2 ADC = Upper Devonian (Famennian)

300' to 1540' - 2 APT (Lower Permian)

Interval 300' - 940'

A collection of spores and saccate pollens characteristic of the Lower Permian (2 APT).

This association is closely comparable with that of the 2 APT unit in Kulshill 2 and St. George Range 1 (Fitzroy).

It is principally composed of Verucosisporites sp (ASr 612, ASr 614, ASr 615).

Saccate pollens are represented by large forms such as Potonieisporites sp. (PAI 201), Parasaccites sp (API 207), Platysaccus papillonis (API 214), Plicatipollenites (API 205).

It is interesting to note that this type of Permian has been found mainly in our studies of Tchad and Nigeria. In Australia it is more common to find association of the 3 APT units characterised by Cirratriradites splenders (ASr 515), etc...

These forms, absent in Keep River No. 1, have been described in St. George Range 1 above the collection encountered in the Permian of Keep River 1.

Interval 1140' - 1540'

The same Permian forms are present, but associated with spores showing Lower Carboniferous affinities ( 3 - 6 ADC)

The detritic nature of the sediment could indicate relict Carboniferous included during Permian deposition . This phenomenon has already been noted at the base of the Permian of Kulshill 1 ( 1 b ATP) and in Bonaparte No. 2 where Upper Carboniferous is mixed with the first Permian deposits.

1600' - 2100' - Unknown Age (Cavings or absence of samples)

Interval 1600'- 1740'

The association Permian - Lower Carboniferous has been found in two samples; in small quantity but well preserved. Core 1 proved sterile despite several samplings. The disappearance of cuttings below 1800' and the microfacies analysis lead to the conclusion that the two samples analysed contain a percentage of cavings.

Interval 1800' - 2100'

No samples.

2100' - 3040' - 3 and/or 4 ADC (Lower Carboniferous)

Core No. 2 (2228' - 2233') has given a basic association of Lycospora sp. (sr 262), and Reticulatisporites sp. (sr 255) which situates it in the Lower Carboniferous.

C3 (3038' -3051') to C 12 (10451' - 10462') 3 ADC (Lower Carboniferous)

In and between these cores has been found an association of forms having few distinctive characteristics, of age undifferentiated Lower Carboniferous. One spore however of the genus Acanthotrilete sp. (sr 1020) has been found, characterisitc of the 3 ADC interval. (St. George Range No. 1, Bonaparte No. 1 and 2)

10600' - 11310' - 3 ADC (?) on cuttings (Lower Carboniferous)

This interval has given an association almost identical with the preceding. It should be noted that intense carbonisation of the material prevented determination of numerous forms.

11710' - 15623' 2 and/or 3 ADC (Lower Carboniferous to Upper Devonian)

Cores 16 (12066' - 12068') to 25 (15617' - 15623') gave no characteristic material. Down to core 23 (14574' - 15578') the rare identifiable forms give an age Upper Devonian to Lower Carboniferous. Cores 24 and 25 are sterile.

In the quartzites of core 23 an association of abundant but very carbonised forms was separated. At least one genera (type Convolutispora, Sr 281?) could be determined. Its age is no older than "Upper Devonian" (possibly Famennian).

2. Extracted Microfauna

The collection of microfauna (Ostracods, conodont, Foraminifera, etc.) extracted by washing or acid treatments permitted the dating of the interval cores 1 to 15. No conclusive results could be obtained in the interval of cores 16 to 21.

Core 7 6391'. 6392'. 6398'. 6399'. 6400'

- Organisms "tubulaires aplatis" (6392')
- Foraminifera: debris (6399')
  - ? Howchinia
  - ? Carbonella
- Crinoids
- Productid spines
- Ostracods: Bairdia sp.

Age: Carboniferous ?

Core 8 6709'. 6711'

Presence of a micro-organism very probably co-specific with an undetermined element, found previously in the Lower Carboniferous in the North of France and in Belgium.

We have previously noted this organism called "Organism Indet TS". It seems to have a real stratigraphic value; visible in washing and thin sections, it commences in the middle part of T m 3a*; on washing attack it has not been found after the middle part of TN 3c, but in microfacies it has been recognised in certain levels of the Visean.

Core 9 7479'. 7483'. 7486'

Azoic

Core 10 8171'. 8173'. 8174'. 8175'

Azoic

Core 11 8925'.8933'

In the 8925' level, elements were found comparable with the "organism of Inded TS" seen in Core 8: This could be a variation of this form or an associated species, seeming to indicate for Core 11, with reserve, an age near or identical to that of Core 8.

Core 12 9907'. 9908'. 9916'. 9917'

At 9916'

- Serpulites
- Productid spines
- Fish teeth
- Gasteropods
- 2 fragments of Conodonts: Spathognathodus sp., Cavusgnathus ? sp.

* see equivalence table (Enclosure 1)

| | Belgien DELÉPINE, 1940 | Deutschland H. SCHMIDT, 1925, VOGES, 1960 — Cephalopoden | Deutschland — Conodonten |
|---|---|---|---|
| VISÉEN | V1α (M. inconstans) | unt. II β+γ / P. kochi (M. inconstans) | anchoralis-Zone ↓ |
| TOURNAISIEN | Tn 3c / P. princeps | II α | |
| | Tn 3b / (M. rotella) | | |
| | Tn 3a | | |
| | Tn 2c | | |
| | Tn 2b | | ↑ |
| | Tn 2a | | Siph. crenulata-Zone |
| | Tn 1b | I / Gattendorfia | Siph.-triangula-Zone kockeli-dentilineata-Zone |
| | Tn 1a / Cy. euryomphala | (ob) VI / Wocklumeria | (Palmatolepis) |

M. = Muensteroceras P. = Pericyclus Cy. = Cymaclymenia Siph. = Siphonodella

Dévonien | Carbonifère

**Abb. 3. —** Parallelisierung der Zonen in Belgien und Deutschland nach den in ihnen gefundenen Leitfossilien unter Conodonten und Cephalopoden (in Klammern Arten, die in mehreren Zonen vorkommen).



| Beurlen, 1927 | | Beurlen, 1935 | | Nordfrankreich-Belgien nach LYS, CONIL, 1962 und BÖGER 1962 | England z.T. nach SIMPSON 1950 | USA, Upper Mississippi Valley nach COLLINSON, SCOTT und REXROAD, 1962 |
|---|---|---|---|---|---|---|
| Pericyclus (II) | Tournaisium | Pericyclus | Basis des Viséum +C2 | unteres Viséum | C2 | Valmeyerian |
| | | Gattendorfia | Tournaisium +Z1-C1 | höheres Tournaisium (Tn 2+3) | C1 Z K | Kinderhookian |
| Protocanites (I) | | | | Calc. d'Hastière (Tn 1b) | | |
| | | Wocklumeria Kalloclymenia | Strunium +K | Strunium (Tn 1a) | - | Upper Devonian |
| Gonioclymenia | Devon | | Famennium | oberes Famennium | Upper Devonian | |
| | | Clymenia Gonioclymenia | | | | |

**Abb. 1. —** Gliederung und Parallelisierung der Schichten an der Devon-Karbon-Grenze.

d'après E. PAPROTH 1963: Die Untergrenze des Karbons.

- Ostracods: Bairdia sp.
  Acratia sp.
  Paraparchites sp.
  Cavellina sp.

Age: Near that of Core 15 (Cavusgnathus?) See Core 15.

Core 13 10452', 10455', 10459'

- At 10459'
- presence of a Conodont fragment: Spathognathodus sp.
- Gasteropods.
- At 10455'
- Paraparchites
- Gasteropods

Core 14 11204', 11206'

- Fish teeth
- Gasteropods
- Ostracods: Cavellina sp.

Core 15 11462', 11466', 11471'

- Ostracods: Cavellina sp.
  Paraparchites sp.
- Fish teeth
- Conodonts: Cavusgnathus?
  Polygnathus sp.
  Hindeodella sp.
  Siphonodella sp.

Age: The presence of the genera Cavusgnathus and Siphonodella and the total microfaunal content indicates:
an age equivalent to the interval Burt Range - Enga-Septimus.
probably to the Burt Range Formation only, i.e. Tournaisian.

Core 16 12066', 12068'

Azoic

Core 17 12251, 12254'

Internal mould - Foraminifera: Nanicella ? sp.

Core 18 12875', 12888'

Azoic

Core 19 13460', 13472'

Azoic

Core 20 13994', 13999', 14006'

Azoic

Core 21 14572', 14579', 14579', 14584'

Azoic

C. ANALYSIS OF TEST FLUIDS

1. Analysis References:

- Lower Carboniferous - test 1 - 6893' - 6963'
- Lower Carboniferous - test 7 - 6443' - 6479'
- Lower Carboniferous - test 8A - 6174' - 6200'

2. Results:

Given in the attached plates and diagrams.

3. Comments

Samples analysed seem representative. Salinity can be observed to augment with depth:

14,5 g/1 test 8 A
20.7 g/1 test 7
28 g/1 test 1

The ratio $\frac{rCl}{rNa}$, near 1, augments with the depth (the ratio $\frac{rSo4}{rCa}$ is not near 1 and does not suggest contamination with evaporites); improving hydrogeologic closure with depth could be assumed.

Water recovered in test 8 A, in the first reservoir level appears reduced in comparison with the others.

$\frac{rCl}{rSo_4}$ = 27.8 (test 8A), against 22.3 (test 1) and 8.5 (test 7)

Nevertheless it is possible the initial reduced character of the water could have been influenced by oxidation during the long delay between sampling and anlysis (1 month)

The waters of test 1, 7, 8 A contain dissolved gas; the G.W.R. and exact composition of these gases is not known.

4. Other Analysis

a. Water.

Complete analyses have not been made, the samples being polluted, values cited underneath could be considered as minimum

- Test 6, 7177' - 7235' - Lower Carboniferous - NaCl 22.5 g/l with dissolved Methane
- Test 4 - 8475' - 1100' - Lower Carboniferous - Methane produced
- Test 3 - 12703' - 12760' - Upper Devonian (Ningbing Limestone) NaCl 34.5 g/l with dissolved methane.
- Test 2 - 13251 - 13405 - Upper Devonian (Ningbing Limestone) NaCl 23 g/l

b. Gas Analyses are noted in the attached table

These are essentially Methane. Notable are:

- a moderate percentage $C_2$ and $C_3$ in test 6A: C1/C2 = 65. Elsewhere the percentage of $C_2$ stays below 0. 6% (C1/C2 > 100)
- relatively high percentage of $CO_2$ in test 3 in the Ningbing Limestone ($\frac{CO_2}{C1}$ = 5 to 32), the origin of this could be related to intrusions in the limestone. In other analyses the percentages are weak $\frac{CO_2}{C1} < 0.03$.

## ANALYSES OF GAS SAMPLES TAKEN FROM THE KEEP RIVER NO. 1 WELL

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Data of Sampling** | 4.12.68 | 31.12.68 | | 8.3.69 | | 14.3.69 | 19.3.69 | 19.3.69 | 22.3.69 |
| **Time " "** | 8 | – | | – | | 8 | – | – | – |
| **Conditions "** | trip gas | Trip gas | | Test n° 3 | | Test n° 4 (P = 350 psi) | Test n°6A (P=350psi) | Test n° 7 | Test n°8A |
| **Depth** | 9 365 | 11.201' (3416m) | 11.255' (3433) | 12 702–12 760 | | 8 475–11 000 | 7177–7235 | 6443–6479 | 6174–6200 |
| **Indications on GD 1** | 77% | 65% | 76% | – | | – | – | – | – |
| **Sample Container** | | **Glass Ampoules** | | **plastic flagon with air and water** | | Gerzat A.4904 | **Metal Ampoule** | **Plastic Flagon with air and water** | |
| | . | n° 1 | n° 2 | n° 6 | n° 7 | N° 6 | n° 20 | n° 15 | n° 10 |
| Air | 36,2 | – | 6,9 | } 90,9 | } 88,9 | – | –– | } 90,4 | } 94,3 |
| $N_2$ | | 7,6 | 6,2 | | | 2,7 | 0,7 | | |
| He | | 0,1(0,07) | 0,1(0,06) | – | – | 0,1(0,07) | 0,1(0,08) | – | – |
| $H_2$ | | 0,1 | traces | – | – | traces | traces | – | – |
| $CO_2$ | tr. | 2,1 | 0,3 | 9,7 | 9,3 | 2,9 | 0,3 | 0,2 | 2,4 |
| $C_1$ | 63,2 | 89,7 | 86,5 | 0,3 | 1,8 | 93,8 | 97,4 | 9,3 | 3,3 |
| $C_2$ | 0,6 | 0,4 | traces | | | 0,5 | 1,3 | tr. | tr. |
| $C_3$ | tr. | tr. | | | | tr. | 0,2 | | |

D - PETROPHYSICAL DATA OF THE CORES

| Core | Depth in feet | K mdy | Porosity ø % | Solid Density |
|---|---|---|---|---|
| 1 | 1 603 | 0,32 | 17,5 | 2,720 |
| | 1 604 | < 0,1 | 14,5 | 2,720 |
| | 1 605 | 0,16 | 10 | 2,699 |
| | 1 606 | 0,20 | 14,2 | 2,729 |
| | 1 607 | 0,46 | 3,9 | 2,656 |
| | 1 608 | 147 | 15,5 | 2,642 |
| | 1 609 | 285 | 13,4 | 2,642 |
| | 1 610 | irregular | 2,9 | 2,703 |
| | 1 611 | < 0,1 | 13,1 | 2,776 |
| | 1 612 | < 0,1 | 11,1 | 2,738 |
| | 1 613 | < 0,1 | 1,4 | 2,669 |
| | 1 614 | < 0,1 | 2,3 | 2,665 |
| | 1 615 | < 0,1 | 2 | 2,664 |
| | 1 616 | < 0,1 | 2,1 | 2,667 |
| | 1 617 | < 0,1 | 3,6 | 2,672 |
| 2 | 2 221 | 54 | 12,9 | 2,646 |
| | 2,222 | 59 | 11,6 | 2,648 |
| | 2 223 | 85 | 12,2 | 2,647 |
| | 2 224 | 127 | 13,7 | 2,645 |
| | 2 225 | 110 | 14,6 | 2,642 |
| | 2 226 | 145 | 14,6 | 2,644 |
| | 2 227 | 50 | 16,3 | 2,644 |
| | 2 228 | 29 | 15,8 | 2,648 |
| | 2 229 | 36 | 16,3 | 2,651 |
| | 2 230 | 47 | 16,3 | 2,712 |
| | 2 231 | irregular | 16,6 | 2,642 |
| | 2 232 | 35 | 16,5 | 2,648 |
| | 2 233 | 45 | 16,1 | 2,652 |
| 3 | 3 040 | < 0,1 | 6,5 | 2,704 |
| | 3 041 | < 0,1 | 4 | 2,709 |
| | 3 042 | irregular | 5,6 | 2,701 |
| | 3 044 | 0,9 x | 6,4 | 2,694 |
| | 3 051 | < 0,1 | 1 | 2,685 |
| 4 | 4 037 | < 0,1 | 2 | 2,732 |
| | 4 043 | irregular | 3,9 | 2,684 |

| Core | Depth in feet | K mdy | Porosity ø % | Solid Density |
|---|---|---|---|---|
| 7 | 6 388 | 0,32 | 3,2 | 2,681 |
| | 6 389 | irregular | 2,3 | 2,675 |
| | 6 390 | " | 2,7 | 2,690 |
| | 6 393 | " | 2,5 | 2,685 |
| | 6 394 | < 0,1 | 1,7 | 2,701 |
| | 6 395 | < 0,1 | 2,1 | 2,677 |
| 8 | 6 709 | < 0,1 | 3,1 | 2,680 |
| | 6 710 | < 0,1 | 2,6 | 2,687 |
| | 6 711 | < 0,1 | 2,6 | 2,677 |
| 9 | 7 481 | < 0,1 | 0,4 | 2,729 |
| | 7 484 | < 0,1 | 0,6 | 2,722 |
| 10 | 8 171 | irregular | 4 | 2,721 |
| | 8 174 | < 0,1 | 0,4 | 2,703 |
| | 8 175 | < 0,1 | 2,7 | 2,669 |
| 11 | 8 925 | irregular | 2,8 | 2,679 |
| | 8 926 | " | 0,8 | 2,692 |
| 12 | 9 907 | < 0,1 | 0,8 | 2,696 |
| | 9 909 | < 0,1 | 0,8 | 2,700 |
| | 9 910 | < 0,1 | 0,6 | 2,742 |
| | 9 911 | < 0,1 | 0,6 | 2,684 |
| | 9 912 | < 0,1 | 0,8 | 2,692 |
| | 9 917 | < 0,1 | 0,7 | 2,690 |
| 13 | 10 452 | < 0,1 | 0,5 | 2,703 |
| | 10 453 | < 0,1 | 0,6 | 2,701 |
| | 10 454 | 0,39 * | 1,2 | 2,690 |
| | 10 461 | < 0,1 | 9,3 | 2,704 |
| | 10 462 | 0,52 * | 0,8 | 2,685 |
| 14 | 11 200 | < 0,1 | 0,5 | 2,652 |
| | 11 201 | < 0,1 | 0,4 | 2,654 |
| | 11 202 | < 0,1 | 0,7 | 2,664 |
| | 11 203 | 0,11 * | 0,6 | 2,658 |
| | 11 204 | < 0,1 | 1 | 2,670 |
| 15 | 11 463 | < 0,1 | 0,8 | 2,719 |
| | 11 465 | < 0,1 | 1 | 2,695 |
| | 11 466 | < 0,1 | 0,8 | 2,693 |
| | 11 468 | < 0,1 | 0,9 | 2,684 |

.../

* - Fissure

| Core | Depth in feet | K mdy | Porosity Ø % | Solid Density |
|---|---|---|---|---|
| 15 | 11 469 | < 0,1 | 0,7 | 2,699 |
| | 11 470 | < 0,1 | 0,9 | 2,676 |
| | 11 471 | < 0,1 | 0,8 | 2,682 |
| | 11 472 | cassé | 0,5 | 2,738 |
| | 11 473 | < 0,1 | 0,7 | 2,705 |
| | 11 474 | < 0,1 | 0,7 | 2,663 |
| | 11 475 | < 0,1 | 0,6 | 2,688 |
| | 11 476' | < 0,1 | 0,7 | 2,698 |
| 17 | 12 251 | < 0,1 | 0,6 | 2,703 |
| | 12 252 | < 0,1 | 0,9 | 2,697 |
| | 12 253 | < 0,1 | 0,6 | 2,703 |
| 18 | 12 875 | | 1,6 | 2,707 |
| | 12 877 | | 1,9 | 2,701 |
| | 12 878 | | 1,5 | 2,706 |
| | 12 879 | | 1,9 | 2,700 |
| | 12 880 | | 1,4 | 2,708 |
| | 12 881 | | 1,7 | 2,705 |
| | 12 884 | | 1,6 | 2,708 |
| | 12 885 | | 2,1 | 2,710 |
| | 12 886 | | 1,4 | 2,704 |
| | 12 887 | | 1,2 | 2,705 |
| 19 | 13 461 | | 0,9 | 2,711 |
| | 13 462 | | 1,8 | 2,703 |
| | 13 463 | | 0,7 | 2,710 |
| | 13 464 | | 0,9 | 2,718 |
| | 13 465 | | 0,7 | 2,708 |
| | 13 466 | | 1,0 | 2,722 |
| | 13 467 | | 0,7 | 2,721 |
| | 13 468 | | 0,8 | 2,720 |
| | 13 469 | | 0,7 | 2,707 |
| | 13 470' | | 0,6 | 2,707 |
| 20 | 13 995 | 0,13 * | 0,8 | 2,707 |
| | 13 996 | < 0,10 | 0,6 | 2,708 |
| | 13 997 | < 0,10 | 0,7 | 2,706 |
| | 13 998 | 0,47 * | 0,7 | 2,709 |
| | 13 999 | 0,24 * | 0,8 | 2,711 |
| | 14 000 | < 0,10 | 0,9 | 2,717 |
| | 14 001 | < 0,10 | 0,8 | 2,702 |
| | 14 002 | < 0,10 | 0,6 | 2,707 |
| | 14 003 | < 0,10 | 0,7 | 2,705 |
| | 14 004 | 16,80 * | 1,0 | 2,704 |
| | 14 005 | < 0,10 | 1,0 | 2,705 |

.../

* : Fissure

| Core | Depth in feet | K mdy | Porosity Ø % | Solid Density |
|---|---|---|---|---|
| 21 | 14 572 | 0,15 ★ | 0,8 | 2,732 |
| | 14 574 | 40,00 ★ | 1,2 | 2,751 |
| | 14 575 | < 0,10 | 0,6 | 2,722 |
| | 14 576 | | 0,9 | 2,724 |
| | 14 579 | < 0,10 | 1,0 | 2,713 |
| | 14 581 | 62,00 ★ | 1,3 | 2,731 |
| | 14 583 | < 0,10 | 0,8 | 2,747 |
| 22 | 15 139 | < 0,10 | 0,9 | 2,789 |
| | 15 140 | 2,18 ★ | 1,4 | 2,817 |
| | 15 141 | < 0,10 | 0,3 | 2,728 |
| | 15 142 | < 0,10 | 0,5 | 2,728 |
| | 15 143 | 0,21 ★ | 0,6 | 2,721 |
| | 15 144 | 31,00 ★ | 1,7 | 2,844 |
| | 15 146 | 0,17 ★ | 1,0 | 2,738 |
| | 15 147 | < 0,10 | 0,4 | 2,734 |
| | 15 148 | < 0,10 | 0,7 | 2,743 |
| | 15 149 | < 0,10 | 0,5 | 2,744 |
| | 15 150 | < 0,10 | 0,6 | 2,738 |
| | 15 151 | < 0,10 | 0,6 | 2,721 |
| | 15 152 | 5,60 ★ | 0,6 | 2,733 |
| | 15 153 | < 0,10 | 0,4 | 2,743 |
| 23 | 15 574 | 0,22 ★ | 0,4 | 2,682 |
| | 15 575 | < 0,10 | 0,4 | 2,698 |
| | 15 576 | < 0,10 | 0,8 | 2,639 |
| 24 | 15 615 | < 0,10 | 1,0 | 2,627 |
| | 15 616 | 0,15 ★ | 0,7 | 2,644 |
| | 15 617 | < 0,10 | 0,4 | 2,651 |
| 25 | 15 618 | < 0,10 | 1,1 | 2,629 |
| | 15 619 | < 0,10 | 0,7 | 2,628 |
| | 15 620 | < 0,10 | 0,5 | 2,703 |
| | 15 621 | < 0,10 | 1,0 | 2,628 |
| | 15 622 | < 0,10 | 1,1 | 2,627 |

★ - fissure

# FICHE D'ANALYSE D'EAU 1. RÉFÉRENCES ET REPRÉSENTATIVITÉ

## RÉFÉRENCES

| | | | |
|---|---|---|---|
| Organisme | | Age géologique | DEVONIAN |
| Périmètre | OP 162 AUSTRALIA | Lithologie | Limestone |
| Puits | KEEP RIVER 1 | Tampon | 8017 |
| Test N° | 2B | Volume sous packer | 1150 l. |
| Date | 6/3/69 | Débit réel | 196 l. |
| Zone testée | de 13 246 m. à 13 300 m. Découvert Perforations | Prélèvement | Débit en surface Remontée Circulation inverse |
| Motif du test | Avancement rapide - zone poreuse, | Pression, kg/cm² | } à m. |
| | | Température, °C | |
| | | N° DICA du puits | N° d'analyse |

## REPRÉSENTATIVITÉ

Indice d'échantillonnage = (Débit réel – Volume sous packer) / Débit réel x 100 = ______ x 100 | i = ____ %

Mesures ~~xxxxxxxxxx~~ C.R.P. (L) sur prélèvements : (L) = Sce EXPLOITATION

| références échantillons | cotes (par rapport table de rotation), m. | mesures sur suspensions densité Baroïd | | | mesures sur phases aqueuses ClNa g/l. | resistivité, Ohms/m2/m | pH | | observations (indices, aspect, etc.) |
|---|---|---|---|---|---|---|---|---|---|
| 4 - 13 200 | | | | | 35,1 | | 8,8 | L | |
| Boue témoin | | | | | 4,7 | | 9,2 | L | |

## INTERPRÉTATIONS ET REMARQUES.

pH o---
ClNa, g/l. •—
Boue témoin

cotes (par rapport table de rotation), m.

SNPA DEP
CENTRE DE RECHERCHES - PAU
GROUPE SÉDIMENTOLOGIE ET GÉOCHIMIE

Service INDICES

Date

NOTE N°

# FICHE D'ANALYSE D'EAU

## 1. RÉFÉRENCES ET REPRÉSENTATIVITÉ

PV/BC/121 - 69

2.

### RÉFÉRENCES

Organisme ........
Périmètre ........ AAP - OP 162 - AUSTRALIE
Puits ........ KEEP RIVER 1
Test N° ........ 4
Date ........ 14/3/69
Zone testée ........ de 8 475 m. Découvert / à 11 000 m. Perforations
Motif du test ........ Indices de méthane

Age géologique ........ Lower Carboniferous
Lithologie ........
Tampon ........
Volume sous packer ........ 40 m3
Débit réel ........ > 15 m3 de boue
Prélèvement ........ ~~xxxxxxxxx~~ ~~xxxxxx~~ Circulation inverse
Pression, kg/cm² ........ } à ______ m.
Température, °C ........
N° DICA du puits ........ N° d'analyse ______

### REPRÉSENTATIVITÉ

Indice d'échantillonnage = (Débit réel − Volume sous packer) / Débit réel × 100 = ______ × 100 | i = ______ %

Mesures chantier (C) / C.R.P. (L) sur prélèvements :

(L) = Sce EXPLOITATION

| références | échantillons | cotes (par rapport table de rotation), m. | mesures sur suspensions densité Baroïd | | | mesures sur phases aqueuses ClNa g./l. | résistivité, Ohms/m2/m | pH | | observations (indices, aspect, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 - | 5' | | | | | 3,95 | | 8,8 | L | |
| Boue témoin | | | | | | 3,2 | | 11,5 | L | |

### INTERPRÉTATIONS ET REMARQUES

pH ........ o---
ClNa, g/l ●—
Boue témoin ----

cotes (par rapport table de rotation), m.

SNPA DEP — CENTRE DE RECHERCHES - PAU — GROUPE SÉDIMENTOLOGIE ET GÉOCHIMIE

Service INDICES

Date ........

NOTE N° ........

# FICHE D'ANALYSE D'EAU 1. RÉFÉRENCES ET REPRÉSENTATIVITÉ



## RÉFÉRENCES

| | | | |
|---|---|---|---|
| Organisme | | Age géologique | Lower Carboniferous |
| Périmètre | OP 162 - AAP | Lithologie | |
| Puits | KEEP RIVER 1 | Tampon | 2000 |
| Test N° | 5 B | Volume sous packer | |
| Date | 17/3/69 | Débit réel | 180 l. |
| Zone testée | de 7510 m. à 7560 m. Découvert Perforations | Prélèvement | Débit en surface Remontée Circulation inverse |
| Motif du test | Estimation de la perméabilité dans un grés fracturé (pertes en forage). | Pression, kg/cm² | } à ... m. |
| | | Température, °C | |
| | | N° DICA du puits | N° d'analyse |

## REPRÉSENTATIVITÉ

Indice d'échantillonnage = (Débit réel - Volume sous packer) / Debit réel x 100 = ........ x 100 | i = ...... %

Mesures ~~XXXXXXXXX~~ C.R.P. (L) sur prélèvements : (L) = Sce EXPLOITATION

| références échantillons | cotes (par rapport table de rotation), m. | mesures sur suspensions densite Baroid | | | mesures sur phases aqueuses ClNa g/l. | résistivité, Ohms/m2/m | pH | | observations (indices, aspect, etc.) |
|---|---|---|---|---|---|---|---|---|---|
| 1- Tampon eau | | | | | 5,2 | | 10,5 | L | |
| 6- Boue de la formation 7330 | | | | | 5,8 | | 9 | L | |
| Boue témoin | | | | | 3,2 | | 10,5 | L | |

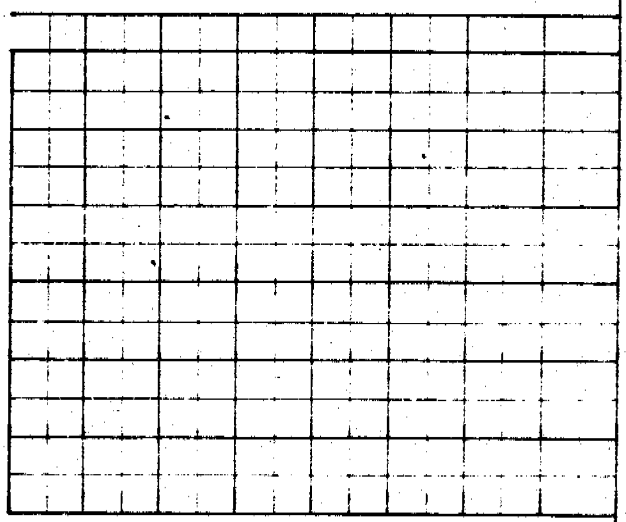
## INTERPRÉTATIONS ET REMARQUES

pH ------○---

ClNa, g/l ---●---

Boue témoin ----

cotes (par rapport table de rotation), m



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GROUPE SÉDIMENTOLOGIE ET GÉOCHIMIE

Service INDICES

Date ........

NOTE N° ........

# FICHE D'ANALYSE D'EAU 1. RÉFÉRENCES ET REPRÉSENTATIVITÉ

4.

## RÉFÉRENCES

| | | | |
|---|---|---|---|
| Organisme | | Age géologique | Lower Carboniferous |
| Périmètre | OP 162 - AAP | Lithologie | |
| Puits | KEEP RIVER 1 | Tampon | 2000 |
| Test N° | 6 | Volume sous packer | |
| Date | 18/[illegible]/69 | Débit réel | |
| Zone testée | de 7118 m à 7234 m — Découvert / Perforations | Prélèvement | Débit en surface / Remontée / Circulation inverse |
| Motif du test | Zone poreuse - saturation eau #/ 60 % | Pression, kg/cm2 | } à m. |
| | | Température, °C | |
| | | N° DICA du puits | N° d'analyse |

## REPRÉSENTATIVITÉ

Indice d'échantillonnage = (Débit réel - Volume sous packer) / Débit réel x 100 = ____ x 100 | i = ____ %

Mesures C.R.P. ( L ) sur prélèvements : (L) = Sce EXPLOITATION

| références | échantillons | cotes (par rapport table de rotation), m. | mesures sur suspensions: densite Baroid | | | mesures sur phases aqueuses: ClNa g/l | résistivité Ohms/m2/m | pH | | observations (indices, aspect, etc.) |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 - Dernier stand 7010 | | | | | | 3,8 | | | L | |
| Boue témoin | | | | | | | | | | |

## INTERPRÉTATIONS ET REMARQUES

pH ---o---

ClNa, g/l —●—

Boue temoin ----

cotes (par rapport table de rotation), m.

SNPA DEP — CENTRE DE RECHERCHES - PAU — GROUPE SÉDIMENTOLOGIE ET GÉOCHIMIE

Service INDICES

Date ........

NOTE N°....

SNPA-CRP Service INDICES N°

# FICHE D'ANALYSE D'EAU

PV/BC/121/69 - 5/69

## 1. RÉFÉRENCES ET REPRÉSENTATIVITÉ

5.

### RÉFÉRENCES

| | | | |
|---|---|---|---|
| Organisme | | Age géologique | Lower Carboniferous |
| Périmètre | OP 162 - AAP | Lithologie | |
| Puits | KEEP RIVER 1 | Tampon | 1000 |
| Test N° | 6 A | Volume sous packer | |
| Date | 19/5/69 | Débit réel | 14 m3 |
| Zone testée | de 7178 m. à 7234 m. Découvert Perforations | Prélèvement | Circulation inverse |
| Motif du test | | Pression, kg/cm² | } à m. |
| | | Température, °C | |
| | | N° DICA du puits | N° d'analyse |

### REPRÉSENTATIVITÉ

Indice d'échantillonnage = (Débit réel - Volume sous packer) / Débit réel × 100 = ________ × 100 i = ____ %

Mesures chantier (C) C.R.P. (L) sur prélèvements : (L) = Sce EXPLOITATION

| références échantillons | cotes (par rapport table de rotation), m. | mesures sur suspensions densite Baroid | | | mesures sur phases aqueuses ClNa g/l | résistivité Ohms/m2/m | pH | | observations (indices, aspect, etc.) |
|---|---|---|---|---|---|---|---|---|---|
| 5- Boue + eau 2800 | | | | | 7,5 | | 9 | L | |
| 6- Boue + eau formation 3100 | | | | | 14,6 | | 9 | L | |
| 9- Eau formation + boue 3920 | | | | | 19,6 | | 8,6 | L | |
| 17- Eau formation + boue 6400 | | | | | 21,8 | | 9 | L | |
| 19- Eau formation + boue 7100 | | | | | 20 | | 9 | L | |
| Boue témoin | | | | | | | | | |

### INTERPRÉTATIONS ET REMARQUES

pH o---

ClNa, g/l •—

Boue témoin

cotes (par rapport table de rotation), m.

SNPA DEP

CENTRE DE RECHERCHES - PAU

GROUPE SÉDIMENTOLOGIE ET GÉOCHIMIE

*Service INDICES*

Date

NOTE N°

# FICHE EAU: *BULLETIN D'ANALYSE*

SNPA-CRP - Sce Indices

| Sté | n° analyse | pays | puits | labo | date analyse |
|---|---|---|---|---|---|
| 1 | | | | | 10 12 68 |

| | | | |
|---|---|---|---|
| Organisme | A.A.P. | Age géologique | CARBONIFERE INFERIEUR |
| Périmètre | OP 162 | Lithologie | Grès |
| Puits | KEEP RIVER 1 | Motif du test | Indices de gaz |
| Mode de prélèvement | DST 1 Date : 26.10.68 | Pertes, $m^3$ | |
| Unité des cotes | ~~xxxx~~ feet Z tr : 92,4 | Débit réel, l. | 16 000 |
| Cotes extrêmes | de 6893,2 à 6963 | | |
| Type du test | découvert ~~perforations~~ | | |
| Cote absolue | | | |
| Pression, $kg/cm^2$ | à | | |
| Température, °C | | | |
| Échantillon analysé | n° 4 | | |

| Indices en forage | tr. | p. | Indices ou prélèvement | tr. | p. |
|---|---|---|---|---|---|
| gaz combustible | x | | gaz combustible | | x |
| gaz non combustible | | | gaz non combustible | | |
| $H_2S$ | | | $H_2S$ | | |
| huile et/ou asphalte | | | huile et/ou asphalte | | |
| aucuns / inconnus | | | aucuns / inconnus | | |

Indice d'échantillonnage, %

Représentativité :

| oui | non | douteuse | inconnue |
|---|---|---|---|
| X | | | |

| | | | |
|---|---|---|---|
| Résidu fixe, à 105°C, g/l | 30 | pH | 7,6 |
| Densité, à 20°C | | , in situ | |
| ClNa (Cl x1,65), g/l | 26 | , ppm | |
| ClNa équivalent, mg/l | | , ppm | |
| ρ, ohm·m2/m, à 20°C, mesurée | | , calculée | |
| ρ, in situ, calculée | | | |
| Viscosité, in situ, estimée, cps | | | |

**VALEURS et PROPRIÉTÉS de RÉACTION**

| | | | |
|---|---|---|---|
| a) alcalins | | salinité primaire | |
| b) alcalino-terreux | | salinité secondaire | |
| c) hydrogène | | salinité tertiaire | |
| d) acides forts | | alcalinité primaire | |
| e) acides faibles | | alcalinité secondaire | |
| % ERREUR | | $rSO_4/(rSO_4+rCl)$, % | |

| IONS | Codes | mg/l | meq/l | R % |
|---|---|---|---|---|
| $Na^+$ | | 9 500 | 413 | |
| $K^+$ | | 100 | 2,5 | |
| $Ca^{++}$ | | 525 | 26,2 | |
| $Mg^{++}$ | | 405 | 33,7 | |
| $H^+$ | | | | |
| total + | | 10 530 | 475,4 | |
| $OH^-$ | | | | |
| $CO_3^{--}$ | | | | |
| $CO_3H^-$ | | 768,6 | 12,6 | |
| $SO_4^{--}$ | | 954,5 | 19,8 | |
| $Cl^-$ | | 15 797,5 | 445 | |
| total − | | 17 520,6 | 477,4 | |
| TOTAL ± | | | | |

**INDICES CARACTÉRISTIQUES**

| | | | |
|---|---|---|---|
| $(rNa+rK)/(rCa+rMg)$ | 6,95 | $rNa/rK$ | 165 |
| $rNa/rCa$ | 15,75 | $rMg/rCa$ | 1,29 |
| $rNa/(rCa+rMg)$ | | $rCl/rNa$ | 1,08 |
| $rSO_4/rCl$ | | $rCl/rSO_4$ | 22,5 |
| $rCO_3H/rSO_4$ | 0,63 | $rNa/rMg$ | 12,28 |
| $\sqrt{rSO_4 \cdot rCa}$ | | $rCl/(rNa+rK)$ | |
| kr | | μ | |
| i.e.b. | | saturation $SO_4Ca$, % | |
| $(rNa-rCl)/rSO_4$ | | $(rCl-rNa)/rMg$ | |

**DOSAGES et RAPPORTS COMPLÉMENTAIRES, mg/l**

| | Codes | | | Codes | | | |
|---|---|---|---|---|---|---|---|
| $NH_4^+$ | | | $I^-$ | | | $NH_4/Cl.10^3$ = | |
| $H_2S$ | | | $Br^-$ | | | $I/Cl.10^4$ = | |
| $S^{--}$ | | | Bore | | | $Br/Cl.10^3$ = | |
| | | | | | | $Bore/Cl.10^3$ = | |

**AUTRES DOSAGES, mg/l**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Li | | $Fe_2O_3$ | | Co | | $SO_3$ | | $NO_2$ | |
| $Fe^{++}$ | | $Al_2O_3$ | | Ni | | $S_2O_3$ | | $NO_3$ | |
| $Fe^{+++}$ | | Sr | | Zn | | S total | | SiO | |
| Al | | Cu | | Mn | | $PO_4$ | | | |

**OBSERVATIONS :** Présence de C1-C2-C3-C4 dissous dans l'eau

Echantillons prélevés (mesures Labo Exploitation)

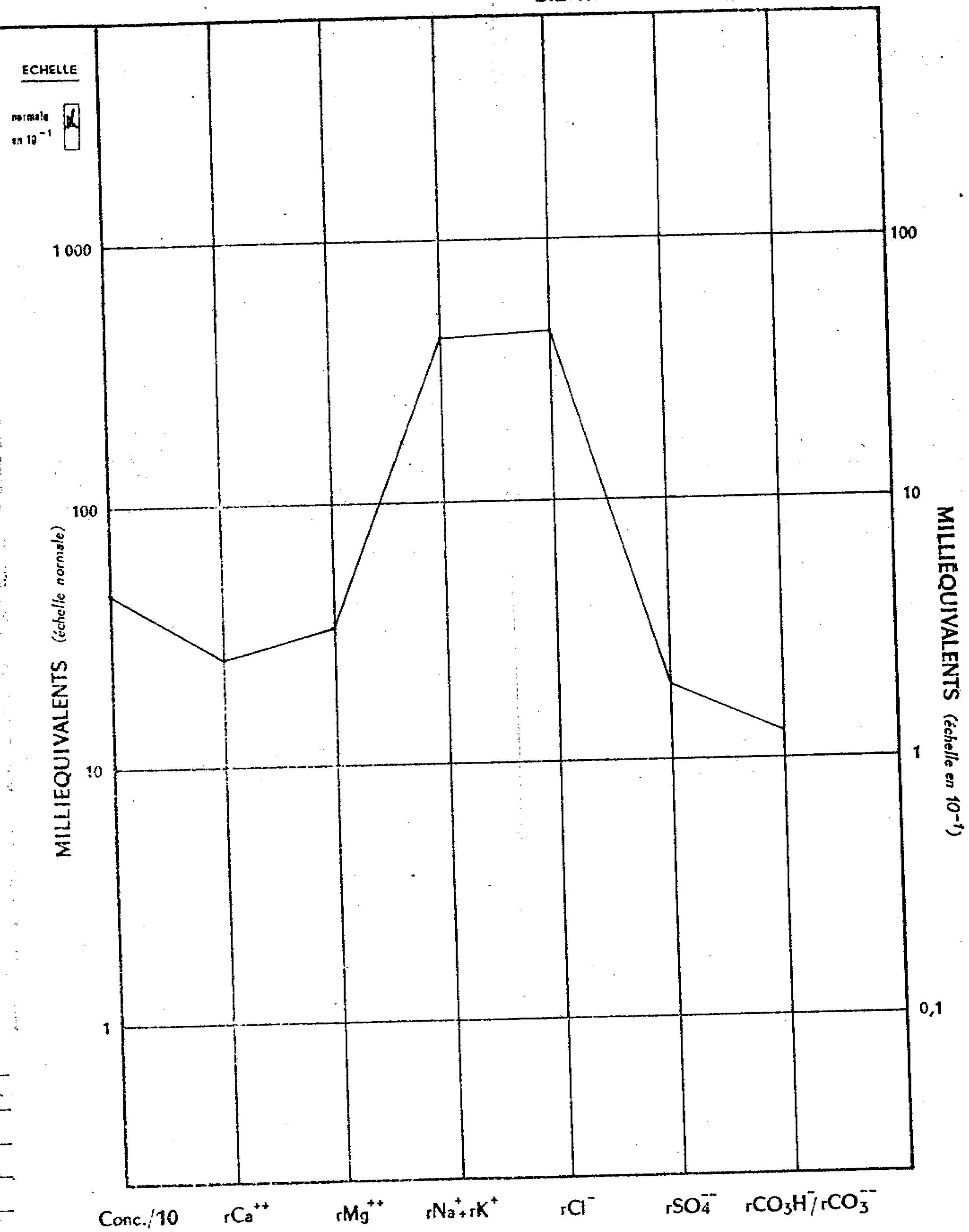
| N° | Cotes/hydrospring | ClNa (g/l) | Résistiv. ohm/m2/m | pH |
|---|---|---|---|---|
| 1 | 4 900 | 15,2 | 0,75 | 9,4 |
| 2 | 2 800 | 25,1 | 0,55 | 7,8 |
| 3 | 1 600 | 22,8 | 0,51 | 8 |
| 4 | 1 100 | 26,0 | 0,51 | 7,6 |
| 5 | 600 | 26,3 | 0,47 | 7,7 |
| 6 | 100 | 24,5 | 0,51 | 7,9 |
| 7 | 0 | 3,5 | 1,27 | 10,4 |
| 8 | hydrospring | 1,6 | 1,34 | 10,3 |
| 9 | Boue fin circulation | 0,4 | 1,80 | 10,4 |

KEEP RIVER 1 - test n° 1

## DIAGRAMME DE SCHŒLLER

Dess. No 4743

| Sté | n° analyse |
|---|---|
| 1 | |



# FICHE EAU: BULLETIN D'ANALYSE

SNPA-CRP - Sce Indices

| Sté | n° analyse | pays | puits | labo | date analyse |
|---|---|---|---|---|---|
| 1 | | | | | 16 4 69 |

| | | | |
|---|---|---|---|
| Organisme | A.A.P. | Age géologique | CARBONIFERE INFERIEUR |
| Périmètre | OP 162 | Lithologie | Grès |
| Puits | KEEP RIVER 1 | Motif du test | Zones poreuses vues sur diagraphies |
| Mode de prélèvement | DST 7 Date : 20.3.69 | Pertes, $m^3$ | |
| Unité des cotes | feet Z tr : 92,4 | Débit réel, l | 13 850 |
| Cotes extrêmes | de 6 443 à 6 479 | | |
| Type du test | perforations | | |
| Cote absolue | | | |
| Pression, $kg/cm^2$ | à | | |
| Température, °C | 77 | | |
| Échantillon analysé | n° 17 circulation inverse | Indice d'échantillonnage, % | |

| Indices en forage | tr. | p. |
|---|---|---|
| gaz combustible | | X |
| gaz non combustible | | |
| $H_2S$ | | |
| huile et/ou asphalte | | |
| aucuns / inconnus | | |

| Indices au prélèvement | tr. | p. |
|---|---|---|
| gaz combustible | | X |
| gaz non combustible | X | |
| $H_2S$ | | |
| huile et/ou asphalte | | |
| aucuns / inconnus | | |

Représentativité : X oui / non / douteuse / inconnue

| | | | |
|---|---|---|---|
| Résidu fixe, à 105°C, g/l | | pH | 8,6 |
| Densité, à 20°C | | , in situ | |
| ClNa (Cl x1,65), g/l | 17,6 | , ppm | |
| ClNa équivalent, mg/l | | , ppm | |
| ρ, ohms/m²/m, à 20°C, mesurée | | , calculée | |
| ρ, in situ/calculée | | | |
| Viscosité, in situ, estimée, cps | | | |

**VALEURS et PROPRIÉTÉS de RÉACTION**

| | | | |
|---|---|---|---|
| a) alcalins | | salinité primaire | |
| b) alcalino-terreux | | salinité secondaire | |
| c) hydrogène | | salinité tertiaire | |
| d) acides forts | | alcalinité primaire | |
| e) acides faibles | | alcalinité secondaire | |
| % ERREUR | | $rSO_4/(rSO_4 + rCl)$, % | |

| IONS | Code S | mg/L | meq/L | R % |
|---|---|---|---|---|
| $Na^+$ | | 6 750 | 293,5 | |
| $K^+$ | | 100 | 2,6 | |
| $Ca^{++}$ | | 350 | 17,5 | |
| $Mg^{++}$ | | 300 | 25 | |
| $H^+$ | | | | |
| total + | | 7 500 | 338,6 | |
| $OH^-$ | | | | |
| $CO_3^{--}$ | | 264 | 8,8 | |
| $CO_3H^-$ | | 646,6 | 10,6 | |
| $SO_4^{--}$ | | 1 680 | 35 | |
| $Cl^-$ | | 10 650 | 300 | |
| total − | | 13 240,6 | 354,4 | |
| TOTAL ± | | 20 740,6 | 693,0 | |

**INDICES CARACTÉRISTIQUES**

| | | | |
|---|---|---|---|
| $(rNa+rK)/(rCa+rMg)$ = | 69,6 | $rNa/rK$ = | 112,4 |
| $rNa/rCa$ = | 16,75 | $rMg/rCa$ = | 1,43 |
| $rNa/(rCa+rMg)$ = | | $rCl/rNa$ = | 1,02 |
| $rSO_4/rCl$ = | | $rCl/rSO_4$ = | 8,5 |
| $rCO_3H/rSO_4$ = | 0,302 | $rNa/rMg$ = | 11,65 |
| $\sqrt{rSO_4 . rCa}$ = | | $rCl/(rNa+rK)$ = | |
| kr = | | μ = | |
| i.e.b. = | | saturation $SO_4Ca$, % = | |
| $(rNa-rCl)/rSO_4$ = | | $(rCl-rNa)/rMg$ = | |

**DOSAGES et RAPPORTS COMPLÉMENTAIRES, mg/l**

| | | | |
|---|---|---|---|
| $NH_4^+$ | $I^-$ | $NH_4/Cl.10^3$ = | |
| $H_2S$ | $Br^-$ | $I/Cl.10^4$ = | |
| $S^{--}$ | Bore | $Br/Cl.10^3$ = | |
| | | Bore/$Cl.10^3$ = | |

**AUTRES DOSAGES, mg/l**

| | | | | |
|---|---|---|---|---|
| Li | $Fe_2O_3$ | Co | $SO_3$ | $NO_2$ |
| $Fe^{++}$ | $Al_2O_3$ | Ni | $S_2O_3$ | $NO_3$ |
| $Fe^{+++}$ | Sr | Zn | S total | SiO |
| Al | Cu | Mn | $PO_4$ | |

**OBSERVATIONS :**

Echantillons prélevés

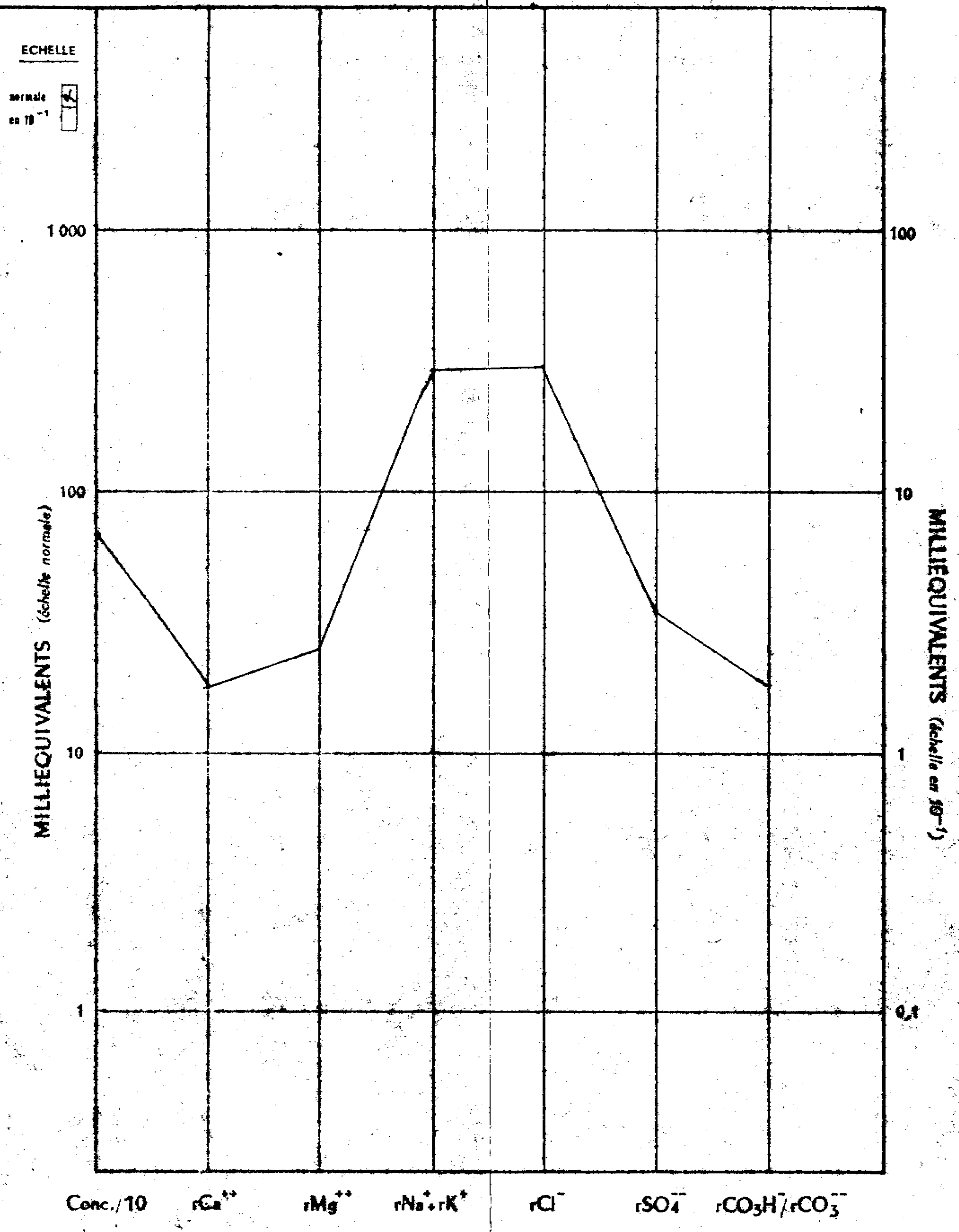
| N° | Cotes/TR | d | ClNa |
|---|---|---|---|
| 1 | 1 500 | 1,01 | 0,5 |
| 3 | 2 200 | 1,09 | |
| 4 | 2 550 | 1,12 | 4,1 |
| 7 | 3 600 | 1,015 | |
| 9 | 4 300 | 1,015 | |
| 15 | 6 050 | 1,01 | 17 |
| 16 | 6 200 | 1,01 | 17,5 |
| 17 | 6 400 | 1,01 | 17,5 |

KEEP RIVER 1 - test n° 7

# DIAGRAMME DE SCHŒLLER

DWG. No 4144

Sté n° analyse: 1



# FICHE EAU: BULLETIN D'ANALYSE

SNPA-CRP - Sce Indices

| Sté | n° analyse | pays | puits | labo | date analyse |
|---|---|---|---|---|---|
| 1 | | | | | 17 4 69 |

Organisme: A.A.P.
Périmètre: OP 162
Puits: KEEP RIVER 1
Mode de prélèvement: DST 8A  Date: 21.3.69
Unité des cotes: ~~XX~~ feet  Z tr: 92,4
Cotes extrêmes: de 6 174 à 6 200
Type du test: ~~xxxxxxx~~ perforations
Cote absolue:
Pression, $kg/cm^2$: à
Température, °C: 77
Échantillon analysé: n° 10

Age géologique: CARBONIFERE INFERIEUR
Lithologie: Grès
Motif du test: zones poreuses sur diagr.
Pertes, $m^3$:
Débit réel, l.: 2 000

| Indices en forage | tr. | p. |
|---|---|---|
| gaz combustible | | |
| gaz non combustible | | |
| $H_2S$ | | |
| huile et/ou asphalte | | |
| aucuns / inconnus | | |

| Indices au prélèvement | tr. | p. |
|---|---|---|
| gaz combustible | | X |
| gaz non combustible | | X |
| $H_2S$ | | |
| huile et/ou asphalte | | |
| aucuns / inconnus | | |

Indice d'échantillonnage, % 70

Représentativité: oui X / non / douteuse / inconnue

Résidu fixe, à 105°C, g/l = 15  pH = 8,6
Densité, à 20°C =  , in situ =
ClNa (Cl x1,65), g/l = 12,2  , ppm =
ClNa équivalent, mg/l =  , ppm =
ρ, ohms.m2/m, à 20°C, mesurée =  , calculée =
ρ, in situ, calculée =
Viscosité, in situ, estimée, cps =

| IONS | Code S | mg/l | meq/l | R % |
|---|---|---|---|---|
| $Na^+$ | | 5 000 | 215 | |
| $K^+$ | | 125 | 3,2 | |
| $Ca^{++}$ | | 200 | 10 | |
| $Mg^{++}$ | | 240 | 20 | |
| $H^+$ | | | | |
| total + | | 5 565 | 248,2 | |
| $OH^-$ | | | | |
| $CO_3^{--}$ | | 240 | 8 | |
| $CO_3H^-$ | | 976 | 16 | |
| $SO_4^{--}$ | | 362 | 7,5 | |
| $Cl^-$ | | 7 401,7 | 208,5 | |
| total − | | 8 979,7 | 240,0 | |
| TOTAL ± | | 14 544,7 | 488,2 | |

**VALEURS et PROPRIÉTÉS de RÉACTION**

a) alcalins =
b) alcalino-terreux =
c) hydrogène =
d) acides forts =
e) acides faibles =
% ERREUR =
salinité primaire =
salinité secondaire =
salinité tertiaire =
alcalinité primaire =
alcalinité secondaire =
$rSO_4/(rSO_4+rCl)$, % =

**INDICES CARACTÉRISTIQUES**

| | | | |
|---|---|---|---|
| $(rNa+rK)/(rCa+rMg)$ = | 7,26 | $rNa/rK$ = | 67,30 |
| $rNa/rCa$ = | 21,50 | $rMg/rCa$ = | 2,00 |
| $rNa/(rCa+rMg)$ = | | $rCl/rNa$ = | 0,97 |
| $rSO_4/rCl$ = | | $rCl/rSO_4$ = | 27,70 |
| $rCO_3H/rSO_4$ = | 2,133 | $rNa/rMg$ = | 10,75 |
| $\sqrt{rSO_4.rCa}$ = | | $rCl/(rNa+rK)$ = | |
| ki = | | μ = | |
| i.e.b = | | saturation $SO_4Ca$, % = | |
| $(rNa-rCl)/rSO_4$ = | | $(rCl-rNa)/rMg$ = | |

**DOSAGES et RAPPORTS COMPLÉMENTAIRES, mg/l**

$NH_4^+$ / $H_2S$ / $S^{--}$ / $I^-$ / $Br^-$ / Bore / $NH_4/Cl.10^3$ = / $I/Cl.10^3$ = / $Br/Cl.10^3$ = / Bore/Cl.$10^3$ =

AUTRES DOSAGES, mg/l: Li / $Fe^{++}$ / $Fe^{+++}$ / Al / $Fe_2O_3$ / $Al_2O_3$ / Sr / Cu / Co / Ni / Zn / Mn / $SO_3$ / $S_2O_3$ / S total / $PO_4$ / $NO_2$ / $NO_3$ / SiO

**OBSERVATIONS:**

Echantillons prélevés

| N° | Cotes/TR | d | ClNa |
|---|---|---|---|
| 1 | 4 950 | 1,01 | |
| 2 | 5 210 | 1,045 | |
| 3 | 5 390 | 1,125 | |
| 4 | 5 570 | 1,140 | |
| 5 | 5 660 | 1,020 | |
| 6 | 5 750 | 1,020 | 10,4 |
| 7 | 5 840 | 1,020 | 11,1 |
| 8 | 5 930 | 1,012 | |
| 9 | 6 020 | 1,010 | 12,3 |
| 10 | 6 110 | 1,010 | 12,3 |

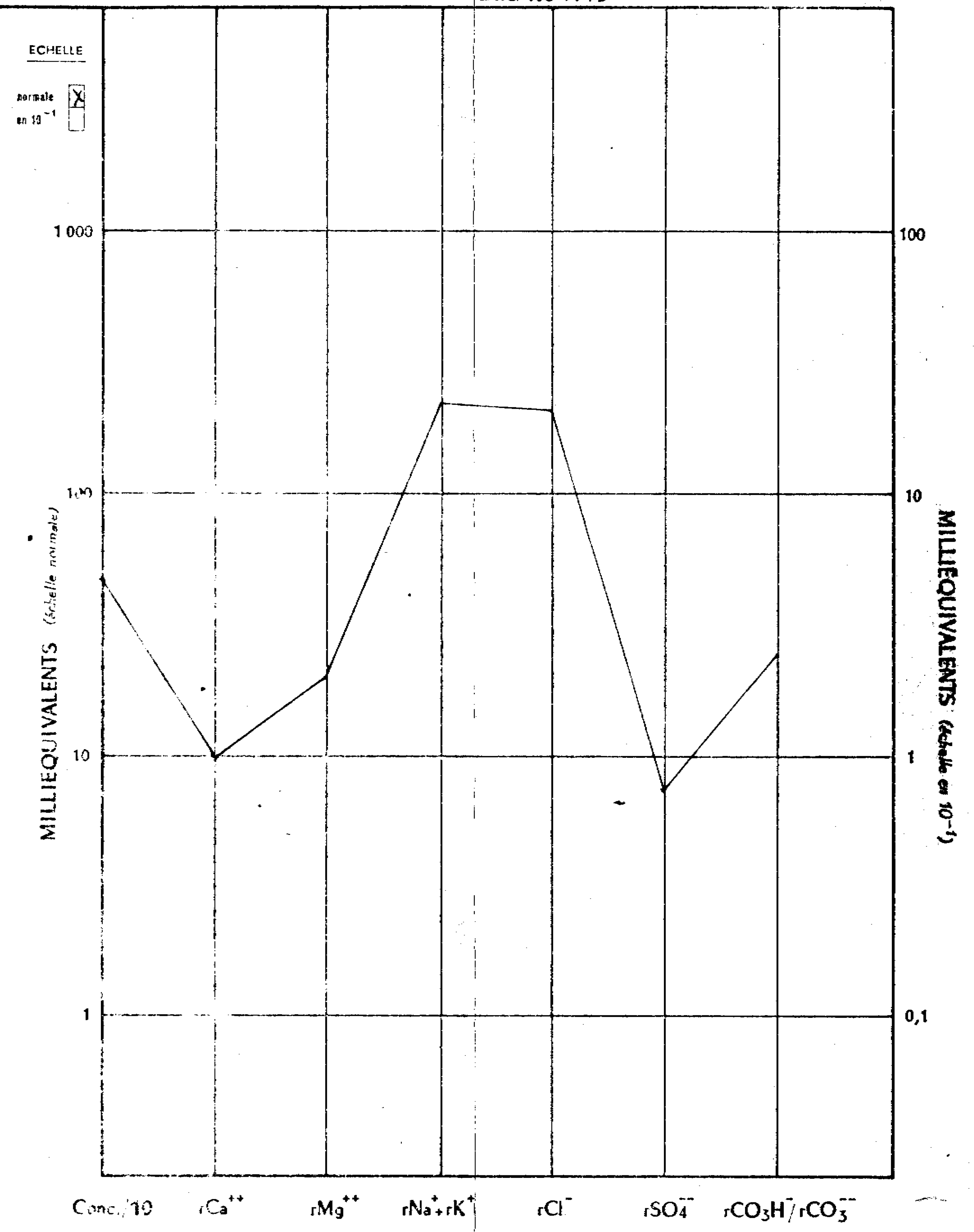
KEEP RIVER 1 - test n° 8A

# DIAGRAMME DE SCHŒLLER

Dwg. No 4745

| Sté | n° analyse |
|---|---|
| 1 | |

ECHELLE: normale X / en $10^{-1}$



# WATER ANALYSIS REPORT

| Co analysis n° | country | well | lab. | date of analysis |
|---|---|---|---|---|
| 1 | | | | |

SNPA-CRP - Sce Informatique

Company :
Permit :
Well :
Type of sampling : Date :
Unit : m. feet Z :
Intervals :
Test type : open hole casing perforations
Absolute depth :
Pressure $kg/cm^2$ : at
Temperature, °C :
Identification of sample :

Geologic age
Lithology
Purpose of the test
Fluid loss $m^3$
Flow rate /

| Cutting or mud shows: | tr. | p. | Shows on sample: | tr. | p. |
|---|---|---|---|---|---|
| combustible gas | | | combustible gas | | |
| non combustible gas | | | non combustible gas | | |
| $H_2S$ | | | $H_2S$ | | |
| oil and/or asphalt | | | oil and/or asphalt | | |
| none / unknown | | | none / unknown | | |

Index of sampling efficiency, % — Validity of sample: good / bad / doubt / unkn.

tr.= traces p = occurence

Dissolved solids 105°C, g/l = pH =
Density, à 20°C = in situ =
ClNa (Cl x 1,65), g/l = , ppm =
ClNa equivalent, mol/l = , ppm =
ρ, ohms/m²/m, à 20°C, determined = , calculated =
ρ, in situ, calculated =
Viscosity, in situ, estimated, cps =

| IONS | codes | mg/l. | meq/l. | R % |
|---|---|---|---|---|
| $Na^+$ | | | | |
| $K^+$ | | | | |
| $Ca^{++}$ | | | | |
| $Mg^{++}$ | | | | |
| $H^+$ | | | | |
| total + | | | | |
| $OH^-$ | | | | |
| $CO_3^{--}$ | | | | |
| $CO_3H^-$ | | | | |
| $SO_4^{--}$ | | | | |
| $Cl^-$ | | | | |
| total − | | | | |
| TOTAL ± | | | | |

## PALMER SYSTEM OF WATER CLASSIFICATION

| | |
|---|---|
| a) alkalins = | primary salinity = |
| b) alkaline earths = | secondary salinity = |
| c) hydrogen = | tertiary salinity = |
| d) strong acids = | primary alkalinity = |
| e) weak acids = | secondary alkalinity = |
| % BALANCE = | $rSO_4/(rSO_4+rCl)$, % = |

## CHARACTERISTIC RATIOS

| | |
|---|---|
| $(rNa+rK)/(rCa+rMg)$ = | $rNa/rK$ = |
| $rNa/rCa$ = | $rMg/rCa$ = |
| $rNa/(rCa+rMg)$ = | $rCl/rNa$ = |
| $rSO_4/rCl$ = | $rCl/rSO_4$ = |
| $rCO_3H/rSO_4$ = | $rNa/rMg$ = |
| $\sqrt{rSO_4 \cdot rCa}$ = | $rCl/(rNa+rK)$ = |
| kr | μ = |
| base exchange capacity = | $SO_4Ca$ saturation = |
| $(rNa-rCl)/rSO_4$ = | $(rCl-rNa)/rMg$ = |

## COMPLEMENTARY DETERMINATIONS AND RATIOS

| | codes | mg/l | | codes | mg/l | |
|---|---|---|---|---|---|---|
| $NH_4^+$ | | | $I^-$ | | | $NH_4/Cl.10^2$ = |
| $H_2S$ | | | $Br^-$ | | | $I/Cl.10^4$ = |
| $S^{--}$ | | | B | | | $Br/Cl.10^3$ = |
| | | | | | | $B/Cl.10^3$ = |

OTHER DETERMINA. mg/l

| | | | | |
|---|---|---|---|---|
| Li | $Fe_2O_3$ | Co | $SO_3$ | $NO_2$ |
| $Fe^{++}$ | $Al_2O_3$ | Ni | $S_2O_3$ | $NO_3$ |
| $Fe^{+++}$ | Sr | Zn | total S | SiO |
| Al | Cu | Mn | $PO_4$ | |

**OBSERVATIONS:**

Code S : B = traces / C = occurence / D = non detected / E = non analysed

Re69/9 H

# SCHŒLLER DIAGRAM

| Co analysis n° |
|---|
| 1 |