GULF ITALIA COMPANY

PHOTOGEOLOGY OF
MOLFETTA, BARLETTA, CANOSA DI PUGLIA PERMITS

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GEOMAP
GEOLOGICAL SURVEYS
FIRENZE - February 1971

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1. INTRODUCTION

The photogeological study of the Molfetta, Barletta and Canosa di Puglia permits has been carried out for Gulf Italia Company and follows the one on the Matera area, finished in April 1970.

The area covered is of approximately 2,700 sq. kms . and is located between 40°45' and 41°20' lat North and 3°30' and 4°20' long. East of Rome. It is included in the sheets nos. 176, 177 and 188 of the official map of Italy at 1:100,000 scale (fig. 1).
The Matera permit is adjacent to the SE and therefore in this report we will often refer to it, for what concerns the introductive parts of general contents of each chapter, the method and techniques used and the regional geology.

The Molfetta, Barletta and Canosa permits are situated between the Adriatic Sea and the Appennines and include the northern part of the Murge region.

The study has been carried out exclusively on air-photos integrating the photogeologic annotation with the most recent cartography and literature. The work was started in September 1970 and was finished at the date of this report.

2. GEOLOGICAL MAP

The geologic map (Plate 1) has been compiled in 3 sheets, at the scale of 1:50,000. It contains all the information obtained from the airphotos, integrated with the data collected in the field by Gulf geologists and from bibliography. The outcropping series does not differ much from the one of the Matera permit and it consists of the following formations, from the bottom:

CRETACEOUS

Bari limestone (C_1) - Barremian-Turonian
It consists of a sequence of detrital limestones, at times with levels with large Pelecypoda and Gastropoda and dolomitized levels, irregulary intercalated. Some of these levels particularly well characterized, have been recognized in the field and sometimes mapped. The most important and continous are the following.

Corato Level (Barremian) - It outcrops in the low part of the Bari Limestone. It consists of white and pinkish limestone with big Pelecypoda.

Palese Level (Albian) - It is found 400 mts above the Corato and is formed by white detrital limestones with Toucasie, alternating with limestones containing Orbitolinides.

Sannicandro Level (Cenomanian) - It is found 800 mts. above the Palese and consists of a bank of white limestone, waxy with Radiolitides.

Toritto Level (Turonian) - It lies 200 mts above the Sannicandro and it is typical for the presence of a bank of macroorganogenous limestone with Radiolitides, Requienides and Nerinee.

Towards the top of the Bari Limestone there is finally a level of thin slate detrital limestone ("chiancarelle").

These levels are not recognizable from the airphotos as they do not have a different morphological aspect and therefore they have not been distinguished on our map. They have been mapped in regular succession from bottom to top, from the seashore towards SW. In the field, besides the levels described, a horizon of breccias and of brecciated limestones (Cb) has been followed, often several tens of metres thick, included between the Sannicandro and Toritto levels. This horizon is visible on the airphotos for a particular "texture" of the image, for the darker tone, for the different morphology and for the lack of visible stratification. Where these three factors are lacking, the position of this horizon has been marked following the bibliography, with a dashed line.

The Bari Limestone, the base of which is not known, even outside the area of study, outcrops for about 2,000 meters. The transition to the overlying Altamura Limestone is at times clearly stratigraphic, at others with the interposition of a brecciated level with subrounded elements, denoting a possible hiatus in between the two formations (see Geological Map of Italy, sheet 190). The environment of deposition of the Bari Limestone is shallow neritic, characterized by a general high energy.

Altamura Limestone (C_2) (Senonian)
It is a calcareous complex, consisting of recurrent sequences of detrital limestones, waxy limestones, calcarenites in banks and beds. In several levels, Rudistae are present both whole and fragmented. The upper part of the series consists of a level, about one hundred metres thick, of dark grey dolomites in banks.

This formation shows in general a more macroorganogenous content than the Bari Limestone and shows levels which indicate possible emersions of the series. Its thickness has been calculated about 900 metres.

The sedimentation environment is a very shallow water, at times brackish with water level oscillations and high energy.

The Altamura Limestone is recognizable on the airphotos from the Bari Ls for its rougher morphology. The contact has been marked following the shape of some more evident key beds.

<u>Brownish Limestone</u> (Oc) (Oligocene?)
Brownish limestones is thick banks, containing Gastropoda (Planorbis) crop out according to what is visible on the airphotos, in an area of about one square kilometer near Jazzo Madama, sheet 188. They are very easily recognizable for the difference of tonality with respects to the surrounding Altamura Limestone. These limestones lie unconformably on the Altamura Limestone and, according to the bibliography, a horizon of red soil with bauxite nodules is present in between the two formations. Their thickness is negligible, in the order of a few tens of meters.

<u>QUATERNARY</u>

<u>Pleistocene deposits in general</u> (Qc)
We have mapped in this group all the relatively recent deposits which are trasgressive over the Cretaceous limestones described above, except the alluvium. The grouping of several types of deposit in a single mapping unit has been done, since for the purpose of this study such sediments are of little interest.
In the unit Qc are therefore included:
- arenaceous limestones, or arenaceous shaly limestones, poorly cemented ("Tufis" of the Murge) of marine environment.
- Post Calabrian marine deposits consisting of coarse sands and calcarenites.
- Marine conglomerates.
- Conglomerates, sands, lacustrine and fluvio-lacustrine shales.

<u>Olocene deposits</u> (Qal)
Terraced and non-terraced alluvium, deposits of the

erosive furrows (Lame delle Murge), stretches of "panchina" along the coast, travertine, talus. The distribution between Qc and Qal has been made because it is relatively easy on the airphotos, although being of scarce importance for this study.

A first glance at the geological map (fig. 2) shows as more evident regional fractures:

- a regional slope of the limestones from the Adriatic coast towards South or SW;
- two belts of concentration of pleistocene sediments parallel to the coast, the first on the Corato-Andira direction and the second passing through Canosa di Puglia. The non parallelism of these belts with the brecciated limestone level, leads us to suppose that they are not controlled by the strike and therefore by stratigraphic differentiations of the limestones, but by structural factors or oscillations of the sea level still referable to structural causes. The parallelism of these two belts of recent deposits with actual shore line and the Bradanic trough (on the direction of Gravina di Puglia) confirms the structural interest of them.
- Another clear tectonic direction appears indicated by the abrupt disappearance or reduction of mesozoic outcrops West of the Barletta-Canosa line, which may be due to a probable lowering of the area NW of that line.

3. STRATIMETRY

We will here breilfy summarize the main introductive principles, more widely illustrated in the Matera report with regards to the strike map.

The stratimetric data can be distinguished into two categories. To the first, belong the dips observed directly on the airphotos. To the second, all those dips deduced by indirect criteria, such as morphology, drainage, etc., and not from the direct vision of the beds. The data of the first category have a high degree of reliability, while the reliability of the data belonging to the second category is the more higher the more coherent the observations are. The two types of data have been distinguished graphically on the geologic map and on the strike map (Plate 2, fig. 3).

The strike map derives from a process of generalization and coordination of strike and dip data to give a more evident visualization of the surface structure. The reliability and the usefulness of such document are directly proportional to the density of dip data annotated. In our case the morphological characteristics, specially in the central-northern part of the area of study, are not favourable for showing stratification and therefore, with respects to the Matera area, the data are scarcer and less correlatable.

More general and synthetic information is supplied by the diagrams of azimuth distribution of bedding strike represented, together with fractures, in figs. 7, 8, 9 and 10, respectively for the total area (also plotted also as a polargraph), for units of one I.G.M. 1:25,000 quadrangle, for stratigraphic unit and by age.

In the present area of study, as we had already noticed in the Matera area the greater majority of the strike directions falls in the NW sector (fig. 7). This direction is then the absolute dominant if we consider the orientation of strike of the cretaceous outcrops (fig. 9). The diagrams of the quaternary deposits, on the other hand, show directions varying according to the area. In particular, to the South of the calcareous outcrops the strike has two marked peaks on the N-S and the E-W, in the westernmost region the strike of the Quaternary varies between N-S, E-W and NW whereas in the Quaternary of the North the main direction is WNW, that is practically identical to the one present in the outcrops of the Bari Limestone nearby (see fig. 9). Evidently, the latter Quaternary outcrops, to the East of Canosa di Puglia, are influenced by the limestone structure as if this were just below the quaternary cover while elsewhere (West of Canosa and to the South, in the area of Gravina) it would seem that the distance from the mesozoic surface is greater.

From a first observation to Plate 2 and to fig. 3 it can be noted how the greater part of the mesozoic limestones dips are uncoordinated at a regional scale, and therefore only small folds of superficial character can be identified with no apparent relation to deep structure. This fact is particularly evident in the northern area. But, if we attempt a regional coordination, even very generalized, of these gentle foldings, as it has been done for the Matera area, we may notice a certain organization of the axes, even higher than it was in the Matera area (fig. 3 bis). As in the previous report, we have lettered and numbered these forms (A for positive fold, S for negative fold). For their dimensions, they can be considered as deformations concerning a great thickness of rocks.

The folds in the mesozoic limestones are all rougly directed WNW and there is a noticeable continuity with the folds identified in the Matera permit. In particular, A5 (Molfetta) seems to correspond to A1 (Matera); S4 to S1; A6 to A2; S5 to S2; A7 to A4; and finally S6 to S3. According to the interpretation given in the report on Matera, these groups of folds were the surface "draping" on a deep structure of the limestones. This structure would be a monocline dipping towards SSW, affected at large scale by dislocations according to a fault block, scheme set along the secondary Apenninic direction (Garganic) and uplifted on the northern side. This type of block structural deformation appeared to be the more coherent to the relatively rigid and stable platform type of the region. Therefore, the major alignments of surface positive structures would be situated on the uplifted margins of the blocks.

In the area of this study a scheme similar to that can still be roughly applied, even if with some variants. The inclination of the monocline dipping towards SSW, already shown by the lithology, seems to be of moderate importance. Infact, attributing a thickness of about 2,000 metres to the Bari Limestone and taking into account the actual topography, the regional dip from the coast to the contact with the Altamura limestone can be estimated in the order of 3 degrees. On the other hand the regular sequence of the key levels recognized in the field and the absence of any repetition over the whole thickness of the Bari Limestone, leads us to think that the faults which cut this monocline in blocks along the strike (secondary Apenninic trend) have not a great throw. Moreover, with respects to the area of Matera, the Apenninic direction of NNW (parallel to the Bradanic through) does not appear as much active over the whole area and does not delimit well characterized blocks, at least according to the stratimetric evidence. On this subject, on the central meridian of the area, we can notice effectively a zone of disalignment of the surface structures which may be due to a trend transversal to the WNW direction. Its nature however will be better defined from the study of the fracture pattern (chp. 5).

In conclusion, in fig. 3 bis we can note a series of positive and negative folds (from A1 to S6) with prevailing secondary Apenninic direction, a few of which, like A5 and A7, with a generalized axis longer than 20 kms. The southern side of the anticlines and consequently the northern one of the synclines is generally longer with respects to the other, giving an average resultant scheme of a monocline towards the South. The axes of the synclines S7 and S8, even if poorly outlined, with their submeridian direction confirm the presence of an abrupt change of structural setting in the region NW of the line Minervino Murge-Barletta. Transversal disturbances are noticeable, as stated, particularly West of the meridian of Molfetta.

4 . MORPHOLOGY

The morphological elements considered are the topographic relief and the drainage. The structural information obtained from these elements is of regional level, even if at times, when suggested by other sources (fractures, geology, etc.) it can give the confirmation of local anomalies.

a) TOPOGRAPHIC RELIEF (fig. 4)
The picture resulting from the altimetric contours, obtained from the 1:100,000 maps with an interval of 100 metres, is extremely simple. It shows a single ridge with the longitudinal axis directed WNW, with a gentle and uniform gradient towards the sea, a slightly steeper slope towards SW and a drop on the western side along an alignment running between N and NNE.

However, we can infer an interesting information on the regional structure, which, even if obtainable from other sources, may probably excape disregarding the relief. This is the result of the simulatenous observations of the following facts:

- The northern Murge, from Canosa to Alberobello (see sheets 176, 177, 188, 189 and 190 of the Geologic Map of Italy and the Matera report) are regionally setting as a monocline structure dipping SSW.
- The contact line between the Bari and the Altamura Limestones, along all this part of the Murge, follows a general direction, except for the indentations and protuberances of the surfaces structure, nearly exactly East-West (more precisely, the contact is included between the meridians 40°55' and 40°58').
- The altimetry of the same area, between Canosa and Alberobello, is, in absolute, raising from East to West and, in particular, the elevation of the contact Bari-Altamura is about 200 metres on the Putignano meridian (F° 190), 300 metres at Acqua-

viva delle Fonti (F° 189), 500 metres on the Altamura meridian and finally 600 metres on the Andria - - Irsina meridian (F° 188).

From the disposition in space of these three data we deduce an uplift by successive fault blocks from East to West with a total vertical displacement of about 1,500 metres (1,000 for the dip and 500 for the topography). The direction of the faults will be defined in the chapter of fractures, but the fact that these dislocations must exist appears quite evident.

Even in the case that we find that the contact between the two limestones is by fault or with an interposed transgressive level (see sheet Monopoli), with an eventual, but not observed neither hypothesized so far, angular unconformity between the two formations, the non parallelism between the regional dip and the topographic position of the key levels (for example the "Toritto") supports the hypothesis of this uplift of the calcareous formations towards East. This fact, when confirmed by other eventual information, from geophysics or subsurface, can be of important for the oil exploration.

Besides what we have described, it seems that from the altimetry we may obtain little else. We have to note the marked cut of the water course "Lama di Macina" - "Lama Balice" South of Bitonto. This creek is interesting as we will see from the drainage analysis.

b) DRAINAGE (Plate 3, fig. 5)
In the kind of relief as the one in the area of study, consisting of a single ridge gently sloping towards the sea, the pattern of the drainage should be as much simple, if lithological, stratimetric or structural factors do not interfere to alter the picture. To put the anomalies in evidence and eventually recognize the causes we have annotated the documents of plate 3 and fig. 5 according to the scheme already used for the Matera report.

We can notice that, among the water divides, the one which follows the main ridge and divides the South-bound waters from the North-bound, is perfectly compatible with the present day relief. The same can be said, even if with some reserve, about the one which divides the Ofanto valley from the drainage going to the sea on the limestones.

An anomalous divide which probably owes its nature to structural causes is the one dividing the course of the Lama di Macina and its tributaries from the water courses further North which go directly to the sea. In order that this river, the Lama di Macina, does not directly to the sea near Molfetta, we have to postulate that there is an obstacle which blocks it in the zone between Corato and Bitonto. Such an obstacle is almost surely of structural origin, since the others factors, stratimetric and lithological, exist also elsewhere with the same characters without disturbing the logic pattern of the drainage. It has to be, therefore, an obstacle which is still raising, otherwise the river, which at present has a considerable erosional strenght, as shown by the shape of the altimetry (fig. 4), would have eroded it. Moreover, it seems to be well defined in a meridian direction as shown by the orientations of the drainage itself and especially by the anomaly of fracture density present SW of Molfetta (fig. 11).

With regards to the drainage pattern in general, we can notice that there is a great number of alignments, mainly along the major fracturing trends. In table 3 we have shown the most evident directions, while in fig. 5 we have tried an interpretative selection of the various trends in the different areas. In the drainage, we still have to note the endoreic Karstic areas as the result of very fractured and tensional zones and therefore structurally higher.

5. FRACTURE ANALYSIS

The analysis of the fracture, according to the concepts stated in the "Method and Technique" chapter inclosed in the Matera report, is carried out through the study of the total field of linears (Plate 4, fig. 6) in the three following phases:

1. Statistical analysis of the azimuth distribution for surface and stratigraphic units (figs. 7, 8 and 9).
2. Analysis of the chronological sequence of the structural trends (fig. 10).
3. Analysis of the distribution of fracture density (Plate 5, fig. 11).

We would like to recall that the first two phases are closely related to one another and aim at the definition of the main structural trends, of the type of deformation caused by them, of the type of structure related to them and of their chronologic evolution. The third phase, density analysis, has instead the more immediate aim of determining areas of more intense deformation; besides more or less supporting the hypothesis formulated on the basis of the other data examined, that is surface geology, stratimetry and morphology.

The azimuth distribution of fractures in this area is very similar to the one of the Matera area. The lower detail of the curves of this area depends on the difference of computing procedure applied in the two areas. For the Matera report, the azimuth selection has been carried out in 16 classes by an automatic counter, in this area however it has been done manually in 8 classes, as an important part of the automatic counter was out of use. If we examine the diagram for the total area (fig. 7), besides a nearly complete similarity in the distribution of strike, we may find the same main fracture trends illustrated in the previous report. We will briefly summarize here the general characters of these trends as they were described in the Matera report.

Principal Apenninic or Bradanic trend

This fracture direction is included between NW and NNW and forms the most important culmination of the frequency distribution. It is called Apenninic as it is parallel to the direction of the Apenninic folds, West and South-West of the area of study. The name Bradanic has given to this component of the Apenninic trend as it is most evidently expressed by the faults of the edge of the Bradanic through. Even if the edge of the Bradanic trough, visible South of our area has a direction more rotated towards the WNW, that is close to the Garganic trend, we believe we can still call "Bradanic" the NW - NNW direction, as, regionally, the above mentioned trough has in fact, that azimuth.

The Bradanic trend seems to consist of quite long faults, generally transversal to the folds of the Mesozoic limestones. The particular intensity of this trend shows how it is connected to phases of intense structural deformation, which involve a considerable thickness of sediments and therefore presumably at least the whole Mesozoic series.

Secondary Apenninic or Garganic trend

The name Garganic of this Apenninic component derives from the importance that this direction of folding and fracturing has in the whole Apulo-Garganic region. In fact, the surface structure, as it results from the stratimetry, indicates this as the most important direction in the tectonic control of the area. In the diagram of fractures for the total area (fig. 7) it is represented by a not too marked culmination centered on the WNW.

As the whole apulo-garganic area may be considered a relatively stable structural element, which has not undergone strong tectonic deformations (at least in comparison to the Apenninic area) it follows logically to think that the structural trend, which determines its most important features, is also the oldest one, that is the one connected to the original situation of the area. We think therefore that the Garganic trend corresponds to the original struc tural grain of the bottom of the basin where the Mesozoic sediments have deposited, and that therefore it has controlled the general shape of the deformations which have affected the apulo-garganic block. These deformations are however the result of the apenninic orogenesis which acted along to a NNW (Bradanic) trend. In this scheme, the Garganic direction has played a determining role in the control of the disposition of the sedimentary bodies of the mesozoic series and of the distribution of facies.

Antiapenninic trend

This trend forms in the diagram for total area (fig. 7) a single large culmination from the NNE to the ENE and therefore it is not separated into two distinct directions, as in the Matera report. The Antiapenninic trend in general represents usually the transversal component complementary to the apenninic foldings. This character seems to exist in our area of study also, confirmed by the absence of a peak in that direction in the bedding strike (the high frequency of the NE direction in the diagrams of Quaternary to the South and to the West, is in fact to be referred more to sedimentary growth lines, rather than to structural strain). On the whole, the antiapenninic trend forms a quite intense system of fractures which is to be kept in consideration for the influence it may have had in determining the secondary permeability of the mesozoic limestones and therefore in favouring the migration of the fluids.

The chronological sequence of the fracture trends (fig. 10) is, also for this area, of little significance, as the outcropping formations are too close in age and there are no terms of comparison of different ages to be able to determine a structural chronology. The Quaternary deposits also, on the whole, do not add anything new to the picture, as if the cover of these deposits in the area considered was too thin to mask the trends of the underlying limestones, even if the are now not active anymore.

From the analysis of the diagrams of fig. 8, we can notice however that in this area there has been a different interaction of the various trends according to the various parts. The Garganic trend, which controls nearly all the foldings of the area, and which does not show a clear active disjunctive component, appears however higly influenced by the other trends with a mainly fracturing character. In the central-western region, on the Barletta meridian, it seems that the associate trend is the Bradanic direction, then the N-S at Molfetta and then the Antiapenninic in the eastern region. Therefore, we should not exclude that the positive relative movements from East to West, postulated in the chapter of morphology (topographic relief) have occurred along directions varying from one area to the other.

We have the same feeling when observing the fracture density map (fig. 11). In this map we can outline several alignments of isodenses which limit portions presumably belonging to homogenous structural units. In fact, the fracture density helps the definition of the single tectonic units which form the framework of the area.

We would like to remember that while examining the density distribution it is better to limit ourselves to consider only prominent differences and more general forms. Areas of recent alluvium, or entirely cultivated, show some "blanks" or a general level of low density owing to the cover. This occurs particularly in the areas covered by quaternary deposits or on the abrasion surfaces of the cretaceous limestones.

The most unteresting feature seems to be the high density zone SW of Molfetta. Various facts, both in the strike map and in the drainage, pointed out this area anomalous. By looking at the density map this area appears as an uplifted block of N-S direction, transversal therefore to the surface structures. This block may give rise to a different type of closure to structures A2 and A3 (fig. 3 bis) alternative to the closure observed on the field of an exclusively stratimetric character.

The other high density area is found in the southern part of the area, on the southernmost limestone outcrops. We can refer this intense concentration of fractures to the particular activity in this area of the faults, with total positive displacement to the East, responsible of the uplifting of the western margin of the limestones. The Bradanic trend, which can be considered the most active direction along which these movements have taken place, seems to have acted jointly with the Garganic trend also influenced by a N-S component.

6. CONCLUSIONS

The purpose of this work was to collect as many data as possible to study the structural characteristics of the area and locate eventual features favourable to the accumulation of hydrocarbons. This purpose was approached according to a scheme already discussed in the previous report on the Matera area, and nevertheless aimed at the research of common factors among the three classes of collected data (stratimetry, morphology and fracture analysis).

The major structural characteristics of the study area are resumed in fig. 12. The area presents itself as a single outcrop of cretaceous limestones, gently sloping from the South towards the sea, limited, to the South and West, by quaternary deposits filling considerably deep troughs (in the order of thousand metres). The main structural cheracteristic of the limestones is that they have a monoclinal setting, dipping towards SSW, with a regional dip of about 3 degrees. On the surface a series of fold axes are visible, more or less continous and defined, directed WNW (figs. 3 and 3 bis) whose origin can be due to a relatively superficial "draping" effect of the limestones on a fault blocks tectonics. This structural model seems to fit the relatively rigid and stable character of the whole apulo-garganic area.

Another regional characteristic of the limestone outcrops is revealed by the combined study of the altimetry (fig. 4 and chapter 4) and of the geology, from Alberobello (out of the area, sheet 190, Geologic Map of Italy) to Canosa. From geometric considerations we have admitted the existence of a series of faults, transversal to the bedding, whose total effect is to have raised the western extremity of the Murge of about 1,000 metres with respect to the central zone located on the Alberobello meridian. On the other hand, the eltimetry, the fracture density and pattern and also the high detail of consistent features of the surface structure, concur to indicate the presence of a structurally high block of Garganic trend in the southernmost outcrop area of the mesozoic limestones. This block would be the northwestern continuation of the "Northern Block" of the Matera area. The transversal faults previously mentioned would have cut this block in secondary elements, progressively raised towards the West.

From the facts mentioned above: monocline dipping southeastward, presence of a Southern Garganic Block, and relative uplifting by transverse faults of the western region, it follows that the highest structural areas of this part of the Murge should be located along the coasal region from Barletta to Trani and, to the South, at the western margin of the limestone outcrops, that is in the area of Minervino Murge. West of Barletta, as we have seen, there is the drop of the Ofanto trough. Following the previous reasoning, moreover, we are inclined to think that important structural objectives are also to be found offshore the Barletta-Trani and the Trani-Molfetta regions.

A less regional feature, but still of large dimensions, is reveable by the analysis of the drainage (fig.5), of the fracture density (fig. 11) and confirmed partly by the stratimetry (fig. 3). The eastward deviation of the Lama di Macina river, the high fracture density shape and the general disroder of the surface structural axes present on the meridian immediately West of Molfetta, suggest the presence in that area of a recent uplift of a block presumably oriented North-South. This structural feature is interesting both as considered on itself and as the boundary of the high area of Barletta-Trani.

From the fracture analysis nothing new was revealed in this area with respects to what was said in the report on the Matera area; on the other hand, the nearly identical results (note the similarity of the diagrams, even with a lower detail) has confirmed and generalized the interpretation of that area. With regards to the trends more largely responsible for the relative uplifting of the western region of the

Murge, it seems that this has been carried out in particular by the NW trend (Bradanic) with the active aid of a North-South and of the Antiapenninic. In particular, in the area of study, we would have had a different predominant component in that type of deformation, according to the region. In the western part the Bradanic would have mainly acted, in the centre (meridian of Molfetta) the North-South and finally in the eastern end of the area, the Antiapenninic. This variation is revealed by the frequency diagrams of fractures (fig. 8), by the drainage pattern (fig. 5) and, above all, by the fracture density (fig. 11).

The relative importance and the actual displacement of the deep structural features of fault block style cannot be determined by photogeological means and, on our opinion, should be the main objective of further geophysical surveys. From this type of investigation it should be then possible to evoluate the real size and importance of some of the superficial structures outlined by dip and strike and possibly the significance of some minor anomalies of the fracture density pattern. We will be therefore very pleased to implement or revise our interpretation when new data will open new possibilities and will give a richer basis for analysis.

Gulf Italia
SOCIETÀ PER AZIONI
SEDE IN ROMA
CAP. SOC. L. 100.000.000 INTERAMENTE VERSATO

20 Settembre 1971

MINISTERO INDUSTRIA E COMMERCIO
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C.C.I.A. N. 290847 - TRIB. ROMA 2116/65 REG. SOC.

Permesso di Ricerca CANOSA DI PUGLIA - Provincia di Bari e Foggia. Rapporto sull'Attività Svolta Durante il Periodo: Aprile 1971 - Agosto 1971.

Abbiamo ricevuto la lettera del 20 Aprile 1971, Prot.N°401472, nella quale ci viene comunicato che, con D.M. del 19 Aprile 1971, il permesso di ricerca di idrocarburi liquidi e gassosi CANOSA DI PUGLIA, in provincia di Bari e Foggia, viene accordato alle società Gulf Italia SpA e BP Italiana SpA, per la durata di 4 anni.

Come lavoro preliminare, nel Dicembre 1969 era stato commissionato alla società contrattista GEOMAP di Firenze, uno studio fotogeologico dell'area in questione e delle zone adiacenti. Il risultato finale di questo studio fu presentato alla Gulf Italia nel Febbraio 1970. Lo studio fotogeologico è stato eseguito su materiale preesistente senza l'invio di personale sul terreno ed una copia completa è stata spedita all'Ufficio Nazionale Minerario per gli Idrocarburi, Sezione di Napoli, nell'Agosto del 1971.

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Sulla base delle mappe così ottenute è stato possibile tracciare un programma di ricerche sismiche.

La Texas Instruments Italia, ingaggiata dalla Gulf Italia SpA e dalla BP Italiana SpA come contrattista, iniziò i lavori sull'area del permesso il 18 Giugno 1971, con la sua squadra sismica N° 754. Questi lavori iniziarono con alcune prove sulla velocità di propagazione sismica dei terreni onde stabilire i migliori parametri necessari per uno studio a riflessione.

I migliori risultati furono ottenuti piazzando l'inizio del cavo dei geofoni a circa 800 m dal punto di scoppio. La profondità dei pozzetti di scoppio si aggira dai 20 ai 40 metri e la carica di esplosivo è di 40 kg per ogni pozzetto.

Dopo aver confrontato i risultati ottenuti variando alcuni parametri, la squadra sismica iniziò delle prove di velocità a rifrazione e poi nuovamente a riflessione. I lavori furono terminati il 27 Agosto 1971, dopo che la squadra sismica ebbe trascorso 22 giorni lavorativi sull'area del permesso.

Tutti i dati ottenuti durante questa campagna sismica a riflessione ed a rifrazione veranno elaborati dalla OGS - Digicon Digital Processing Center a Bari.

Distinti saluti,

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CN/lv.