CONFERENCIA

THE QUESTION OF TURBIDITY CURRENTS IN THE OFICINA FORMATION

Panel Discussion by: L.M. Banks[1]
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Session chairman: G.A. Young[5]

The publication of a recent paper entitled "Two Theories of Deposition of Oficina Formation, Eastern Venezuela" by R. Passega, L.E. Barnes and J.S. Pittman Jr.[6] has occasioned considerable comment on the question of whether or not turbidity currents were really one of the means by which the sediments of the Oficina formation were deposited. As this subject is one that affects the entire thinking of the geologists working on sedimentation, paleontology and paleoecology of the Eastern Venezuelan basin, the Asociación thought that the possibility of the existence of turbidity currents should be discussed by those who have worked extensively in the area. The discussion was held in the Salón de Actos del Colegio de Ingenieros de Venezuela on 28 May 1958. The following report of that discussion consists of an introduction to turbidity currents by Alberding, comments on deposition by Dallmus, and critiques by Banks and DeSisto.

Introduction by the chairman:

The object of this panel discussion on "The Question of Turbidity Currents in the Oficina Formation" is to critically examine what is known about the mode of deposition of the Oficina formation and then try to decide whether or not turbidity currents had a prominent role in the mechanics of the deposition. Mr. R. Passega was the originator of the idea that turbidity currents existed and has been the principal protagonist, writing three or four articles on the possibility of their existence. It is only natural then that his interpretation of the facts, or perhaps even the facts themselves, will be open to criticism in a discussion of this nature. It is unfortunate that Mr. Passega can not be here to present his bases for the idea, but in lieu of this, his articles have been read thoroughly and the bases or the facts will be presented by the panelists. Mr. Alberding, since he worked and discussed the idea with Mr. Passega, has been asked to give a definition of turbidity currents and present some of the arguments used by Passega for the existence of turbidity currents.

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1. Mene Grande Oil Company
2. Signal Oil and Gas of Venezuela (formally Phillips Petroleum Co.)
3. Creole Petroleum Corporation
4. Mene Grande Oil Company
5. Mene Grande Oil Company
6. Bull., AAPG, Vol. 42, No. 4, April 1958. pp 881-886

MR. H. ALBERDING

I have been requested by the chairman of this committee to express the ideas of Mr. Renato Passega on turbidity currents as applied to the deposition of the Oficina formation in eastern Venezuela. Although I do not necessarily agree with all of the ideas of Mr. Passega in this matter, I have consented to speak on his behalf because of his absence and because I have known Mr. Passega for years and I am familiar with his ideas.

Defined, a density or turbidity current is a highly turbid and relatively dense current which moves along the bottom slope of a body of standing water. The currents have been observed in lakes and reservoirs and have been created artificially (especially by Prof. H. Kuenen). Clearest evidence of their existence in the oceans was afforded in 1929 by the successive breakage of transatlantic cables by a southward-moving turbidity current formed by slumpage connected with the Grand Banks earthquake. Heezen and Ewing calculated, from the time between breaks and the length of broken cables, that the current had a front of 150 miles, a course more than 400 miles long; and, at 250 miles from its origin where the slope was less than 1°, a speed of 15 knots. The deposit laid down by this current consists of a layer of graded silt and muddy sand, 40 to 130 cms thick.

This is clear evidence of the cutting power of a turbidity current and some marine geologists attribute the cutting of submarine canyons to turbidity currents formed where sediment-laden rivers debouch into the sea. Slumpage along the foreset beds of deltas and even heavy storms can also stir up sediment and set turbidity currents in motion and, once started, a slope of less than 1° is sufficient to keep them going. Coarse clastics ranging up to boulder size are sometimes transported by the currents and deposited far from shore. Shallow-water marine or fresh-water fossils are likewise often transported by these currents hundreds of miles out to sea. Indeed evidence has been presented suggesting that some deposits in the deep trough off the north coast of Puerto Rico were transported from north to south across the Atlantic from as far away as Newfoundland and eastern Canada. Such deposits would be expected to have wide-spread horizontal extent.

Not many geologists deny the existence of turbidity currents; our concern this evening is whether turbidity currents deposited the Oficina formation in eastern Venezuela.

The Oficina formation was laid down on the southern slope and shelf of the Eastern Venezuelan sedimentary basin during the Oligocene and earliest Miocene (Burdigalian). It varies in thickness from 600 feet in the Temblador area to 10,000 feet in the Greater Anaco area and consists predominantly of gray shales interbedded with siltstones, sandstones, lignites and minor beds of limestone. Sandstones make up 30% of the formation in the Greater Oficina area and are sheet and channel in outline. As many as 75 lignites are present in the Oficina formation in the Chimire area and eight of these extend over 100 square miles. Many of the lignites have roots extending into underclays and thus must be autochthonous. Others are allochthonous, according to Moore and Shields. Combined faunistic and lithologic evidence have suggested to most geologists that the Oficina formation was laid down under a typical paralic environment, i.e., alternating fresh-water, coal-swamp (paludal) and brackish to shallow-water marine conditions of deposition. Passega thinks otherwise.

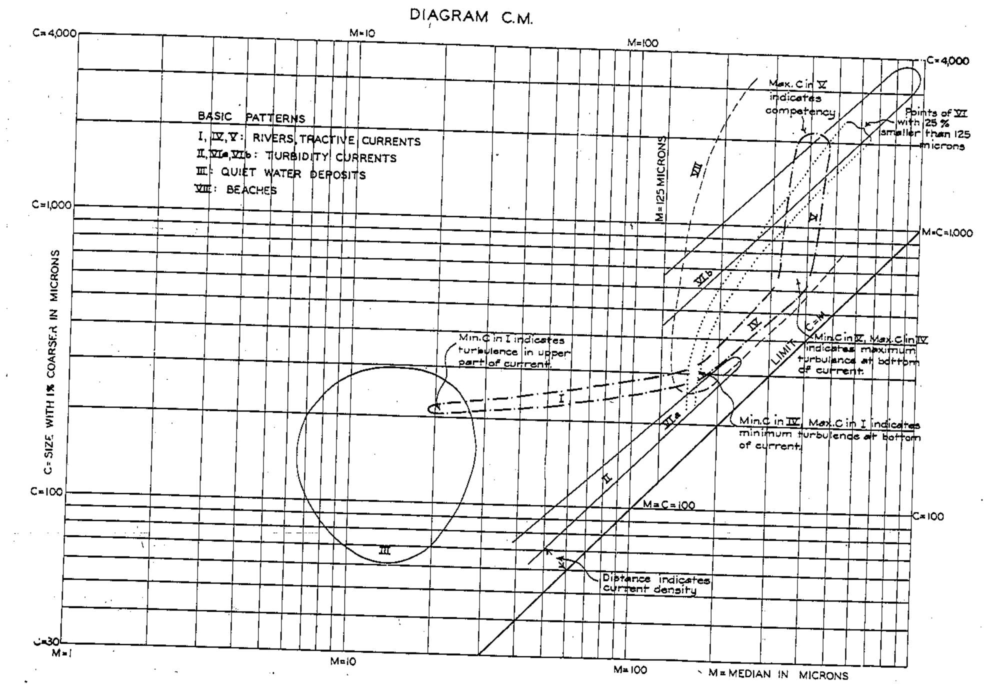

Figure 1. Basic CM patterns (Fig. 12 of Passega, 1957)

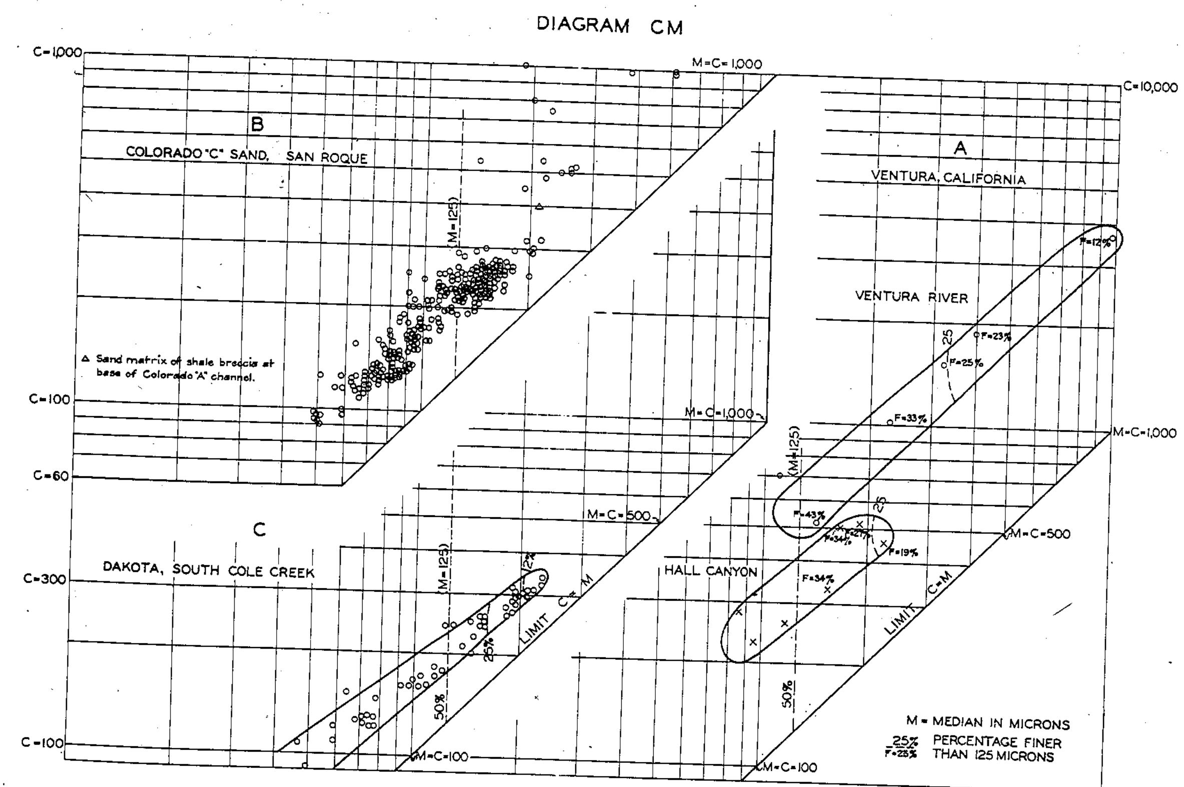

Figure 2. CM diagrams of turbidity-current deposits: A - Pliocene, Ventura, Calif.; B - Colorado sands, Oficina formation, Oligocene, San Roque, Venezuela; C - Dakota sandstone, South Cole Creek, Wyoming. (Fig. 9 of Passega, 1957)

According to Passega, if the shore line had migrated during the change from shallow-water marine to swamp conditions during the deposition of the Oficina formation, an interfingering of facies would occur, quite different from the layer-cake arrangement of many of the Oficina beds. Also, many of the coarser clastic beds are graded and are of wide extent horizontally. Passega questions the ability of any means of transportation other than turbidity currents to account for the widespread distribution of the blanket sandstones and siltstones and mudstones of the Oficina formation.

Regarding the general absence of pelagic and benthonic fossils in the Oficina formation, Passega ingeniously suggests that the Eastern Venezuelan basin was at least partially closed during Oficina times, and, as the shells of these pelagic organisms sank to the bottom, they were dissolved by the acids which formed under the stagnant bottom conditions. Brackish-water arenaceous fossils, however, were transported out into the basin by the turbidity currents and were quickly covered and preserved. Passega also calls upon these stagnant bottom conditions to account for the preservation of the vegetal debris which formed the lignites of the Oficina formation. He suggests that vegetal debris accumulated on the surface of the Eastern Venezuelan basin over extensive areas, became water-logged, and sank to the bottom to form the lignites. This could apply to those which are allochthonous.

Further evidence of turbidity currents is given by Passega in his study of grain-size analyses. He believes that certain characteristic patterns result by plotting medium grain sizes of a sample against a one-percentile coarse grain size of the same sample and that turbidity current deposits can thereby be distinguished from beach sands, river deposits, etc. (Figure 1, from Passega, R., 1957). He finds that the plot of grain-sizes of samples from the Colorado "C" sand at San Roque in eastern Venezuela is characteristic of turbidity currents (see Figure 2,B). The efficacy of this method has been questioned.

MR. L.M. BANKS

Geology is still basically an inductive science in a fact-gathering stage of development, and we should avoid rash generalizations based on a limited number of observations and unwarranted deductive reasoning. Starting from known facts, if we are not careful, we can carry ourselves trhough a world of fancy and make-believe and arrive at some fantastic conclusions hard to prove or disprove. The important thing is the fact or body of facts upon which a theory is construed. If our knowledge of the facts is one hundred per cent correct, we can use them as evidence for or against something. Evidence of this type, with a high degree of cogency, results in proof. Facts that are poorly understood, and therefore not properly interpreted, cannot become evidence. I emphasize the problem of what is fact, what is evidence and what results in proof because a full realization of basic premises can help us express an opinion on the controversy on turbidity currents and the origin of Oficina sediments. This is all the more desirable since we cannot prove or disprove Passega's concepts to anyone's complete satisfaction.

Although I do not believe in Passega's concepts, I will not attempt to convince you of my views, at least directly, but will confine my discussion to an enumeration of Passega's basic observations and evidence for his theory, which will be discussed and confronted with the observations and evidence for the Hedberg-Sass-Funkhouser-Renz theory as offered by these workers and myself. In his latest paper Passega has promised to discuss this latter theory but has not done so.

PASSEGA's DATA AND EVIDENCE FOR DEEP WATER ENVIRONMENT AND DEPOSITION OF OFICINA FORMATION BY TURBIDITY CURRENTS

Observations or Facts	Interpretation (Evidence)
1953 Paper	
1. Absence of evidence of subaerial erosion . . .	Presented as evidence for stable sea-level (no oscillation) and a depositional environment which did not change greatly.
2. Root remains in coals not noticed	Root remains are absent. Therefore no swamps existed and coals are transported.
3. Absence of near-shore primary structures . . .	Evidence that Oficina sediments are not near-shore deposits but were deposited a considerable distance, possibly 100 miles from shore, in quiet deep water.

Observations or Facts	Interpretation (Evidence)
4. Channel sands are local equivalent of blanket siltstones and are inter bedded with shale similar to blanket shale.	The channel sands are not river deposits.
5. Graded bedding	Indicative of turbidity currents in deep seas. The Colorado sands are similar in composition and texture to sands cored in the deep seas.
6. Cross-bedding	Not used for evidence as such, but statement that characteristics of silt suspension, high velocity and low viscosity can favor development of cross-bedding.
7. Blanket beds of extreme lateral uniformity and persistence and basinward thickening	Indicative of deposition in a large body of deep quiet water.
8. Similar deposits in Greater Oficina	Probably similar conditions of deposition prevailed in Greater Oficina area.
1954 Paper	
No additional data or evidence is offered in this paper.	
1957 Paper	
9. C-M plot	Typical of turbidity currents (Pattern VI).
1958 Note	
10. Laterally persistent and uniform, extensive lignites	This cannot be gained in swamp.
11. Merecure sands are transgressive beds	Therefore it is normal that the Merecure should be overlain by deep-water sediments.
12. Axial zone of geosyncline a few miles north of Eastern Anaco and during Oligocene this axial zone was receiving submarine slides of boulder conglomerates from the mobile belt as reported by Renz and others	As a slope of a few degrees seems required for long distance transportation by sliding, the axial zone, and with it the Anaco area, must have been deep.

In summary, Passega suggests that the Oficina sediments are deep sea deposits, laid down in a large body of deep, quiet water, possibly 100 miles from shore in the case of the Colorado at San Roque, mostly by turbidity currents. To me, the most important aspect of his theory is the environment of deposition he suggests rather than the speculation on turbidity current action, since the validity of the latter depends largely upon the validity of the suggested environment. To repeat, evidence involves fact and its interpretation, but interpretation in this sense should not be confused with surmise and speculation. It is best to keep fact and speculation clearly separated at all times. So let us examine his evidence, bearing this in mind.

First of all, it should be made clear that Passega's investigations are confined to a limited study of the Colorado member of the Oficina formation at San Roque, from which he reaches a broad, rash generalization applicable to the entire Oficina formation of Central Anzoátegui. Sometimes he seems to confine his remarks to the Colorado at San Roque, but when arriving at a fundamental conclusion he undoubtedly refers to the entire formation.

For purposes of this discussion I invariably refer to the Oficina as a whole, not just the Colorado at San Roque.

Item No. 1 - Absence of subaerial erosion:

This fact cannot be accepted as such. What is true is that he has not noticed, or has not accepted, any evidence of subaerial erosion. From Krumbein's table of criteria for the recognition of unconformities, I can list five different criteria for subaerial erosion in the Oficina, namely: asphaltic and oil-stained zones; buried soil profiles; land plants and stumps in place; undulatory surface of contact; abrupt changes from marine to continental beds. Krumbein also calls attention to the limitations of subsurface data. Was the coring at San Roque extensive enough to permit the conclusion that such evidence is completely absent because it was not noticed? Because it is based on an erroneous "fact", the interpretation given is not warranted at all and cannot be accepted as evidence.

Item No. 2 - Absence of root remains in coals:

The fact is accepted, but the interpretation cannot be accepted because of the limitations of subsurface data and because root remains may be rare occurrences. As a matter of fact, root remains and stumps are known from Greater Oficina according to Funkhouser (personal communication).

Item No. 3 - Absence of near-shore structures:

The same objections are raised as regards this observation and its interpretation.

Item No. 4 - Channel sands are local equivalents to blanket beds:

The observation may be acceptable although the wording is somewhat vague. It is implied that the blanket beds are marine deposits and therefore the associated channel sands must be marine also. The interpretation is indeed a bold conclusion not justified by the cursory investigation conducted by Passega. Coal beds are also associated and interbedded with the sandstones and siltstones and shales, but on this ground alone it would be too irresponsible to consider these coal beds of similar marine origin.

Item No. 5 - Graded bedding:

Not all graded beds are deposited by turbidity currents nor are all turbidity current deposits graded. Grading of Oficina sands in Greater Oficina is similar to that of Recent and ancient river deposits described by Nanz (1954). Pettijohn (1949) says the origin and significance of this structure is in part an unsolved question.

Item No. 6 - Cross-bedding:

Quite understandably, Passega does not make an issue of this structure, which he describes as being common, for it is generally accepted that cross-bedding, also known as current bedding, is incompatible with turbidity currents and deep water. Graded bedding and current bedding are mutually exclusive and the distinguishing marks of two facies of sedimentation (Pettijohn, 1949, p. 137). Cross-bedding can be considered a near-shore primary structure. One cannot, of course, be too dogmatic about the significance of these structures; each case must be carefully studied before such facts as graded bedding and current bedding, still not fully understood, can be offered as evidence for or against something.

Item No. 7 - Lateral uniformity of blanket beds:

The observation refers to the excellent regional correlation of the Oficina formation. The beds may be considered blankets in this sense, although they are also marked by extreme lenticularity. If the fact is acceptable with reservations, the interpretation is not fully warranted. Do we really know the significance of lateral persistence? Does excellent correlation necessarily mean deposition "in a large fairly deep body of water?" Item No. 7 may be considered the most important evidence for Passega's concept in that this observation must have been the starting point of his theory. We should remember that, first of all, he wants to present "evidence" of deep water environment which did not change much throughout Oficina time. As a matter of fact, this concept is in turn used as evidence for turbidity current action as the only explanation of the occurrences of coarse sediments in deep water. According to Passega, all Oficina sediments, including the coal beds could have been distributed by these currents. However, "evidence" that requires an explanation does not constitute evidence. As far as I am concerned, the turbidity current part of the theory is not too important. The stable, unchanging deep water marine environment is what I am worrying about. If I should ever believe in Passega's unchanging environment, I should also believe in Oficina turbidity currents. It should be recalled that turbidity currents are only known indirectly, from the deposits they make, but have not been directly observed in nature, according to the published reference (SEPM Symposium, 1951). The work on turbidity currents started 20 years ago. They were invoked to explain submarine canyons and the occurrence of coarse sediments in deep water. Passega speaks of deep water but does not say how deep is deep. I believe that marine geologists mean at least 1500 feet when speaking of deep water. Let us consider the case of the Pliocene sediments of the Ventura basin studied by Natland and Kuenen (1951). There they had good faunal evidence to demonstrate depth of water in excess of 4500 feet; however, the validity of the faunal evidence was seriously questioned because of the interstratification of coarse sands and conglomerates with the fossiliferous shales. Later studies revealed certain lithologic characteristics of these sediments, such as graded bedding and absence of cross-bedding, which pointed to turbidity currents in deep water to reconcile the conflicting evidence. Passega's work recalls the pattern of this paper, except that he has a much harder time to prove a deep water environment for the Oficina in the absence of faunal and petrographic evidence.

Item No. 8 - Similar deposits in Greater Oficina:

The interpretation of this valid observation is indeed fully warranted, although it is not evidence for his theory but perhaps evidence against his theory. Otherwise, we will have to revise his account of events to eliminate incongruencies in the current explanation which arise from the validity of Item No. 8.

Item No. 9 - C-M plots:

The C-M plot is not a proved method but just another technique to handle mechanical analysis data. J.C. Ludwick (Private report, Gulf Oil Corporation) has raised objections to the claims made by Passega on the significance of the C-M plot. The C-M plot cannot be used as evidence for or against anything at the present stage of knowledge. Among examples of turbidity current deposits on the basis of the C-M plot, Passega includes the Colorado of San Roque and the Berea sandstone. These two examples would appear sufficient, in my opinion, to question the significance of the C-M plot. As noted by Ludwick, most geologists will refuse to consider the Berea, which is a stable-shelf quartz sand, strongly cross-bedded, and has been described as one of the most ripple-marked sands in West Virginia and Ohio, as turbidity current deposit. I feel that the Colorado and Berea sands serve to prove that the C-M plot is not at all a proved method.

Item No. 10 - Lateral persistence of lignites:

This is another bold interpretation that cannot be accepted. Why could we not have big swamps? The Greater Oficina area is about one fourth that of the Delta Amacuro. What about the large Florida swamps? The extensive coal beds in the Pennsylvanian of the Eastern United States have never been thought of as having formed in a deep water marine environment, as implied by Passega, just because they are extensive. Before arriving at hasty pronouncements of this sort, one would do well to conduct a thorough investigation of the coal beds, map them individually, and actually measure the areas covered. Only then one would be able to offer precise data on their extent, shape, mode of occurrence, and other characteristics, still largely unknown in the case of the Oficina coals, from all which a more scientific judgement could be offered as to their origin and significance. It should be recalled that little or no attention has been paid to these "lignites" other than for correlation purposes. How then, could we offer an account of their formation just on the basis of a vague appreciation of their extent? Oficina coals, while indeed remarkably persistent, pinch out or shale out also, sometimes quite abruptly. The largest, single coal bed I have been able to trace on electric logs, without interruption, covered bout 1500 square kilometers, or only about 15% of the total petroliferous area of Central Anzoátegui.

Item No. 11 - Merecure sands are transgressive:

This is mere speculation of little or no importance as evidence in favor of Passega's theory.

Item No. 12 - Axial zone of geosyncline near Anaco:

The statement reveals unfamiliarity with Oficina geology. Passega and his co-workers must be confusing the present-day structural axis with the depositional axis in Oficina time. Available isopach data do not reveal this axial zone of the geosyncline, but a continuous thickening to the northwest is indicated up to the mountain front and the end of the record. Passega and his co-workers have also misinterpreted

Renz et al. (k) in attributing them the observation as regards submarine slides of boulder conglomerates during Oligocene in the alleged "axial zone" near Anaco. Renz et al. spoke of minor beds of conglomerate and submarine slumping in connection with the Miocene La Pica. In Oligocene time, the sedimentary axis is suspected to have been somewhere near Barcelona along the present-day mountain front, as the sedimentary record seems to indicate a continuous thickening up to the frontal thrust. This foredeep in the geotectonic sense (Renz et al., 1955) was a geographic environment of very shallow water marine to brackish water and continental beds exemplified by the Capiricual and Lower Quiamare formations of the Santa Inés group in northern Anzoátegui (Renz, 1957) which grade southward into the Oficina formation. According to Renz, the Capiricual (about 12,000') consists of dominantly shallow water marine shales, sandstones, congomerates, mottled claystones and lignites, while the Quiamare formation (about 10,000'), which is in part ascribed to the Miocene, consists of largely non-marine claystones, sandstones, conglomerates and coal beds. No one has yet ventured to suggest a deep water environment for these sediments.

In summary, I am inclined to believe that Passega's concept and evidence, when confronted with the orthodox view, may be likened to an attempt to make a one-pound weight outweigh a ten-pound one. He may be right after all, but I am sure his view cannot be accepted on the basis of our currently endorsed geologic science.

Besides those already mentioned, the following errors of fact and observation need correction. With reference to the occurrence of coal in the Oficina formation, Passega speaks of "several" interbedded lignites which increase in number shoreward (f. 1954, p. 1877). It is difficult to realize the volumetric importance of Oficina coal from this vague description. It would appear more precise to say that, on the average, coal constitutes about 2% by volume of the Oficina formation in Central Anzoátegui. Coal content may jump as high as 3.5% by volume in the lower part of the formation or be as low as 0.8% in the upper Oficina. There may be about 1.0 - 1.3 beds of coal per 100 feet of section in central Greater Oficina. Considering the thickness of the formation, this means that there may be, on the average, about 75 coal beds in Greater Oficina and as many as 120 beds in Anaco. I would not call this number just "several". The observation that coal beds increase in number shoreward is not quite true. Coal beds are most abundant in central Greater Oficina and decrease in number both northward and southward from this area.

Passega and his co-workers (1958) have stated that the Anaco area has accommodated about 4000 feet of Oligocene beds. I would say that the area has accommodated at least 8000-12000 feet of deposits of this age. They also state that basinward thickening and lateral uniformity "seem to require a spreading bottom current acting in a large body of fairly deep water." Basinward thickening is commonplace in unstable basins and has been interpreted as due to differential subsidence during deposition. Either he is wrong in his conception of the geotectonic and geographic environments or we will have to revise the orthodox views on the subject.

In 1954, Passega offered the following explanation: "A considerable thickness of sediments was involved in each sequence of slides..... The origin of the swift turbidity currents can be reconstructed as follows. Large quantities of sediments were deposited by nearshore agents..... Movement in a zone of gravity faults abruptly formed submarine scarps. The unconsolidated sediments of the upthrown blocks, no longer supported, collapsed as a sequence of submarine slides and created sufficient turbulence to form swift turbidity currents. Although the mother sediments had been deposited by nearshore agents, the locality where the currents originated was not necessarily near shore when the currents formed. The Greater Oficina area is crossed by a zone of gravity faults which may have been the source of the Oficina

currents." With this explanation, Passega seems undeterred by the available record. There is absolutely no evidence of submarine slumping in a large or small scale in Greater Oficina. If a considerable thickness of sediments was involved in each sequence of slides, we should find a likewise considerable thickness of beds missing in the upthrown blocks in Greater Oficina. All we find is the usual thinning characteristic of faulting formed during deposition, a common feature in most petroliferous basins of mild deformation. The lateral persistence and excellent correlation of beds is just as remarkable in Greater Oficina as in Anaco, and from the above account by Passega Greater Oficina was a shallow nearshore environment where submarine slides and turbidity currents originated. Therefore, lateral persistence, the most important characteristic behind Passega's theory, can be produced in an environment other than a large body of deep, quiet water. In the 1958 note, the above account has been modified as follows. "Rivers were depositing large volumes of deltaic sands and muds on the shallow shelf. Subsidence was not sufficient to accomodate all of these sediments on the shelf and a large part was dumped in the zone of flexure and faults, bordering the shelf on the north. Just north of this zone of flexure the fairly unstable slope had a considerable subsidence that determined sharp and ample movements along the faults of the flexure zone. In the deltaic sediments situated on the relatively steep slopes of the flexure zone, the movements caused submarine slides and turbidity currents." It will be seen that the sediments of Greater Oficina are now called deltaic, yet they are laterally persistent and easy to correlate. The various elements and concepts in Passega's theory cannot be reconciled among themselves.

Finally, his account of events is incongruous when faced with an earlier belief that the conditions prevailing at San Roque extended to Greater Oficina. Again the question must be raised. Is his theory applicable to the entire Oficina formation or is he applying it only to the Colorado of San Roque? If he refers to the Colorado of San Roque only, then the 1958 note does not bear the proper title.

Let us now examine the data and evidence for the orthodox view, which Passega has refrained from discussing in any detail.

DATA AND EVIDENCE FOR THE ORTHODOX VIEW

	Facts	Interpretation
1.	Presence of shallow-water marine and brackish water faunas	A good indication, if not actual proof, of shallow and brackish water environment
2.	Absence of deep water fossils	Good evidence, if not actual proof, of the suggested geographic environment
3.	Presence of coal beds	Coal of the type found in Oficina is generally accepted as evidence of coastal swamps and continental environments
4.	Sandstone textures and structure	Nothing incompatible with deposits of the suggested environment
5.	No haphazard distribution of lithologic types	Indication of sea level oscillations and good argument against Passega's concept.

	Facts	Interpretation
6.	Similarity with cyclothemic sedimentation	Good evidence, in not actual proof, of sea level oscillations and changing environment.
7.	Common fungus remains (sclerotia and spores)	In coals..... indicative of in situ degradation under aerobic condictions.
8.	Underclays	Indicative of subaerial weathering and lowering of base level.
9.	Root systems in coals	Good evidence and actual proof of in situ origin of coals.
10.	Coal content considerably higher in the lower, less marine part of the formation	Although it may be a coincidence, a good evidence, if not actual proof, of the indicated environments.
11.	Lithologic types	Typical of the deposits of the continental platform with "sedimentation paralique" of Tercier. A good indication of the suggested environments.
12.	Microscopic studies reveal close similarity between Oficina coals and Coos Bay coal and West Coast coals	Coos Bay and West Coast coals have never been thought of as derived by a transported origin. A similar origin is indicated for Oficina coal.
13.	Similarity between Oficina reservoir and the Seeligson sand described by Nanz	The Seeligson sand is interpreted by Nanz as a continental deposit. A similar origin is indicated for Oficina channel sands (river deposits).

To summarize, we can quote the following statement (Renz, 1957). "Combined faunistic and lithologic evidence indicates that the Oficina formation was deposited in typically paralic environment characterized by the interplay of fresh-water, coal swamp (paludal) and brackish to shallow water marine environments. The lower part of the section was deposited in predominantly fresh to brackish waters, and the upper part in mainly shallow marine waters which were intermittently turbid and clear."

It is interesting to emphasize the orderly and cyclic arrangement of lithologic types. Coals are always associated with sandstones, or sandy intervals, where the sandstones are not well developed, and with underclays where these are present. The coals without underclays are not necessarily transported (abnormal coals of Wheeler and Murray, 1957). Coals are never found in an interval, i.e. marine shale interval, without a designation in the sandstone nomenclature scheme of the Oficina. Under Passega's regime, there is no reason why this should be so, for coal and other lithologic types could be developed anywhere in the section, since conditions of deposition remained the same. As it is, cyclically recurrent environments are strongly suggested. It is also a remarkable coincidence, which cannot be considered fortuitous, that coal content should be high where we have the biostratigrapher's assurance, on the basis of biofacies, of brackish and fresh water environments. The ratio of coal in the lower part of the Oficina to that in the upper part is generally 2 to 1 and even 3 to 1. I was unaware of the classification of environments by the

biostratigraphers when I made the estimate of the quantitative volumetric distribution of coal, and as far as I know the normal view on the Oficina environments was advanced without a knowledge of this quantitative coal distribution. Coal disappears altogether in the Miocene Freites, where the marine conditions initiated in Upper Oficina were well established. To sum up the discussion, we cannot ignore the remarkable concomitant variations in coal content and type of environment indicated by the biofacies.

Before I finish, you may want to hear what Ph. H. Kuenen has to say (personal communication). He expresses his belief that the lithologic types and petrographic characteristics of the Oficina formation, as described by Passega, do not indicate deposition by turbidity currents. He doubts any connection between Oficina coals and density currents for another reason also. A mixture of bog material with sea water would have a lower density than the latter. It could only form a turbidity current if mineral sediment were added. Hence the deposit might be peaty but not a peat, and the coals would not have the purity that characterizes them. The microscopic studies of coals and the interpretation of them was made by James M. Schopf, of the U.S.G.S. Coal Geology Laboratory in Columbus, Ohio, to whom I sent six samples of representative coals from Greater Oficina and Anaco. Unaware of the controversy on the genesis of these coals, as he explained in a second letter authorizing the release of the results of his investigation, Dr. Schopf volunteered the following explanation. The Oficina coals are essentially humic banded coals with fairly common fungus remains (sclerotia and spores) indicative of in situ degradation. They closely resemble the coal of the Coos Bay in Oregon as to type composition and aggregation, although evidently the rank of the Venezuelan coal is higher. The Venezuelan coal does not show the particle size consistency that characterizes the detrital organic fragments that contribute to non-banded coals, and certainly nothing in the thin sections indicated a more than normal admixture with detrital mineral grains.

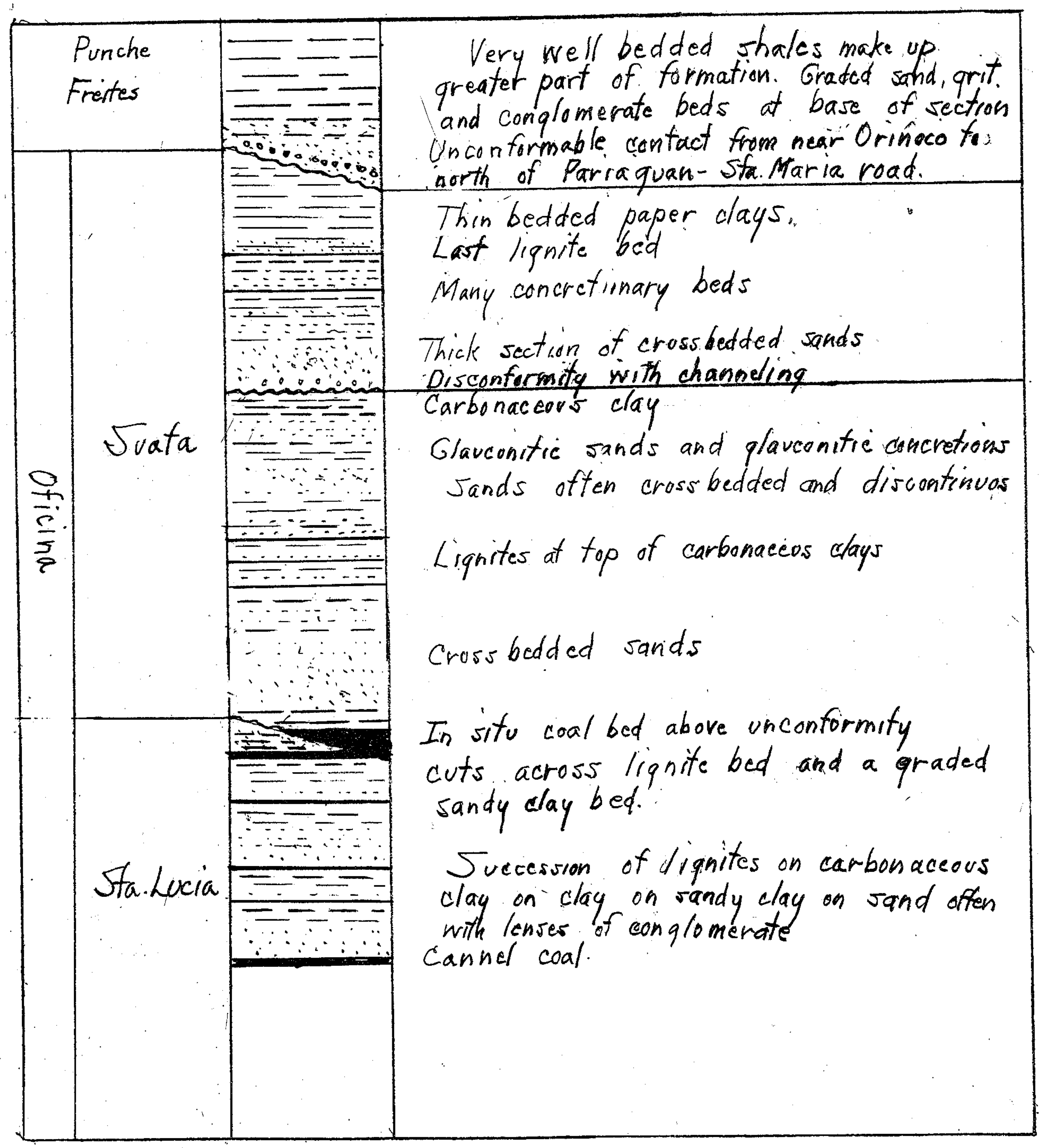

Figure 3. Outcrop section of the Oficina formation near Rio Suata

MR. K.F. DALLMUS

I am not going to handicap myself by talking in favor of turbidity currents, as Alberding has done, or against turbidity currents, as Banks has, but I am going to present the facts and let you draw your own conclusions. As Mr. Banks pointed out in discussing geological problems we must not confuse interpretations and conclusions with facts and we also have to be careful when we use some authority's opinion as facts.

First of all, then, let us see what we know about the Oficina formation, both on the surface and in the subsurface.

Let us take a look at the surface outcrop of the Oficina formation where it outcrops to the southwest of the Oficina area (Figure 3). The stratigraphic section shown on Figure 3 can be observed near the Río Suata and west of the Quebrada Santa Lucía. At the top of the section is the Punche formation, which is the surface equivalent of the Freites formation. It is primarily a shale formation with a conglomerate at the base and it lies unconformably on the Suata formation. The unconformity can be observed in outcrops all the way from about 15 kms north of the Orinoco to north of the Pariguan - Sta. María road.

As Mr. Banks pointed out about the unconformities in the Oficina, at this unconformity there is absolutely no evidence of subaerial erosion. There are no typical minerals characteristic of a weathered zone.

The formation itself is almost entirely shale with a few thin sand and concretionary beds. At the bottom is a massive sand which becomes conglomeratic at the base and grades upward into shale.

The Suata formation is unconformably overlain by the Punche formation and it has an unconformity in the middle. At the top of the first member there are thin bedded clays, which are very characteristic; lower in the section are concretionary beds and lignite beds. These lignite beds are exposed in the outcrops, sometimes more than 300 feet long. These lignite beds are at the top of cyclothemic successions, at the bottom is a sand. Above the sand is a graded succession of sandy shale, pure shale, carbonaceous shale and at top is a lignite or coal bed, which may vary from a fraction of an inch to important thicknesses. That type of sedimentation is confined to the central part of the upper member. At the base there is a disconformity with channels; again there is absolutely no evidence of subaerial erosion. Wherever it is seen, the basal beds lie on fresh beds below without weathering products of any kind. The lower member has the same characteristics as the upper member. At the top, there is a succession of sands and shales; the sands are corss-bedded, and are typical of what is known as deltaic deposits. They are highly discontinuous, the same bed disappears in the same outcrop, so that within 100 m. there is not evidence of a sand.

In the middle part again, there is a sequence of cyclothemic deposition. At the base, there is a thick section of cross-bedded sands. The base of the section is found in a quebrada north of the bridge of Sta. Lucía. There is a coal bed that truncates a coal bed below; the coal bed above the unconformity cuts across the coal below. That is, in my opinion, the only in situ coal bed that I have seen in that section. There is evidence that the coal grew in that bed. Below that, in what we call the Sta. Lucía formation, there is again the cyclothemic sequence: a sand, sometimes a conglomerate, at the base, dirty sands above, sandy clays, clays, carbonaceous clays and the coal bed on top. In that sequence there is one bed of solid coal, a lustrous cannel coal, about 2 m. thick.

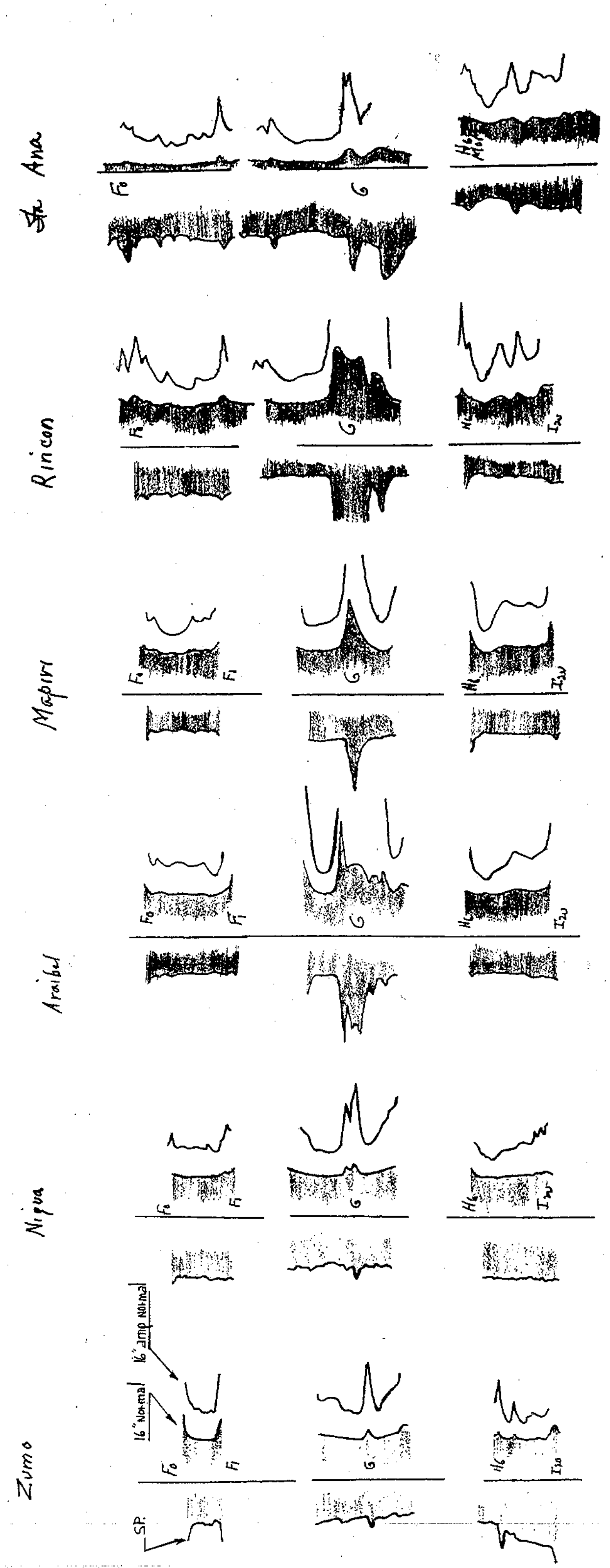

Figure 4. Three east-west cross-sections from Zumo to Santa Ana, showing the shale intervals above the F_1, G and I_{2u} sands.

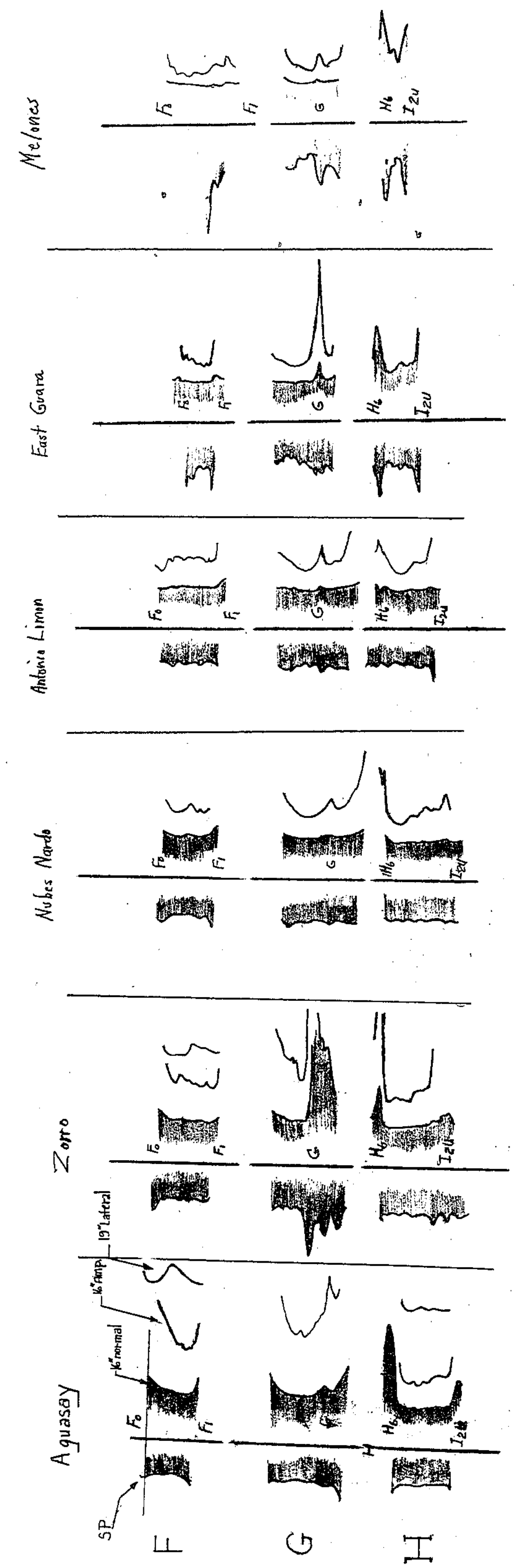

Figure 5. Three north-south cross-sections from Aguasay to Melones, showing the shale intervals above the F_1, G and I_{2u} sands.

This surface section is one that anyone can see, and each can form his own opinion. It is not the opinion of someone else.

Now, let us look at the subsurface: Short sections of the electric logs (Figure 4) from Zumo on the east to Sta. Ana on the west. The shale sections have characteristic profiles that can be traced from the eastern part of the Oficina area to the Sta. Ana area. The upper cross-section shows the shale between the Fo and F_1 sands, the second shows the shale profile below the G sand. Near Zorro, the G sand has sanded up in the middle and is supposedly one of the channel sands. At the bottom is the shale interval between the H and the I_2 sand. One of the small kicks of the amplified 16" curve carries all the way across this section. Many of these kicks are characteristically recognizable.

East-west sections show the lateral continuity (Figure 4). The north-south sections are even more remarkable than the east-west sections (Figure 5). Some of the shale wriggles can be traced from Aguasay to Melones, and the correlation is corroborated by lignite beds above and below the characteristic, traceable wriggles. To me it is absolute evidence of continuity, both laterally and perpendicular to the strike. By what process that was formed I am not prepared to say.

An example of a channel sand is shown on Figure 6. The F_6 sand maintains its character all the way across the section. However, the F_5 is a mere pip on each side of the field, but thickens to 40 feet in the center of the field. The remarkable thing is that there is practically no variation in thickness for a specific section, that is, from the F_o to H sands, across the field. On the east side the thickness is 630 feet between correlation points, and on the west side the same interval is 640 feet. The individual thickening of sands has no apparent effect on the overall thickening toward the northwest of the larger units.

Now we can take a look at how sediments are laid down off the coasts of today. If you have flown over the Mississippi delta, or where any of the other large rivers enter the ocean, you have probably noticed one thing: that the dirty water stops at a definite line at a comparatively short distance from shore. In the Mississippi delta area, it may be 40-50 miles out to sea, but beyond that the water is clear. All the sediment drops out within a very short distance from shore. Therefore, in order to deposit the sediments out farther from shore, there has to be some other mechanism besides deposition near shore. Another thing, all the deposits in the world in their primary site of deposition are near-shore deposits. They have the characteristics of near-shore deposits; they carry shallow-water fossils, carbonaceous material, and all the characteristics of shore deposits.

On a static or rising coast, one finds a type of deposition illustrated by Figure 7. A bar is formed off shore with a lagoon behind. A good example in Venezuela is the coastline near Higuerote. At the present the beach extends all along the coast, and back of it there are extensive lagoons. At Higuerote, and inland 4-5 kms, there is an old abandoned beach. The road that goes to Río Chico is constructed on the old beach, which in the Gulf coast is called a chenier. Back of this ancient strand, are other swamps. This is typical of deposition on all coasts that are static or rising. A point in connection with the Gulf coast, the offlap of all the formations on the Gulf coast means that the coast has been rising and has not been going down as is commonly thought. The sediments are being built out into the water because there is a lot of sediment.

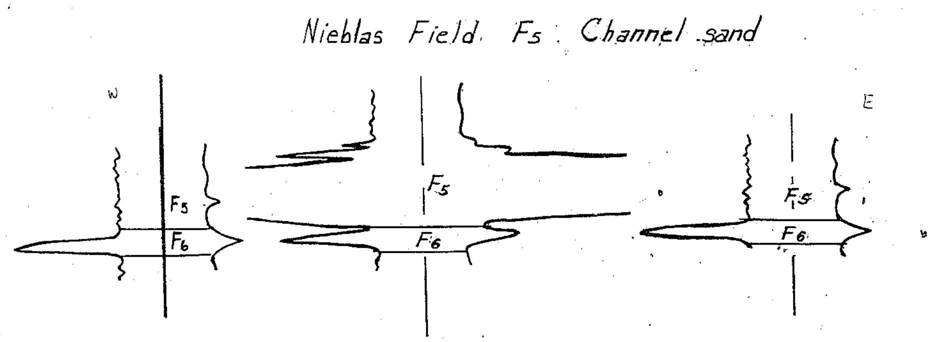

Figure 6. Channel sand development in the F_5 sand, Nieblas Field.

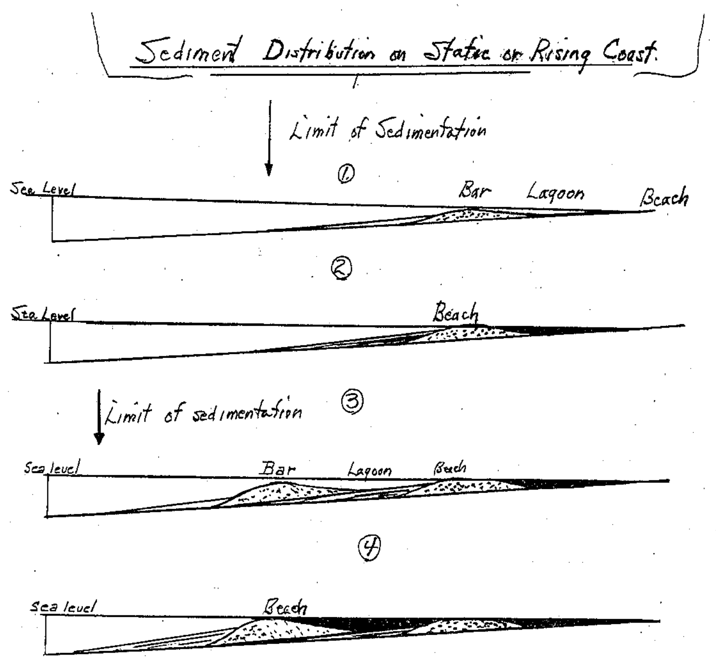

Figure 7. Sediment distribution on a static or rising coast.

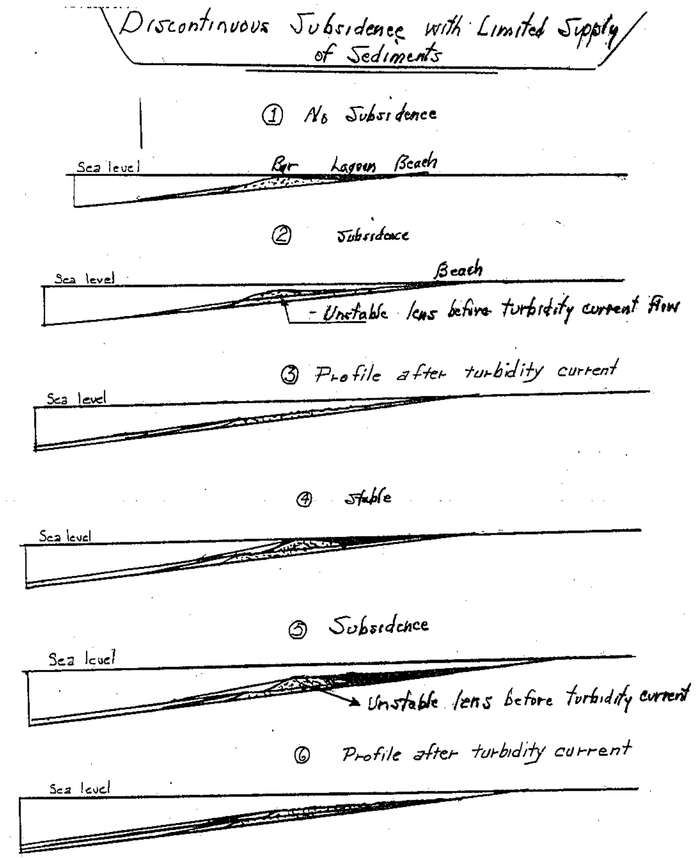

Figure 8. Discontinuous subsidence with a limited supply of sediment.

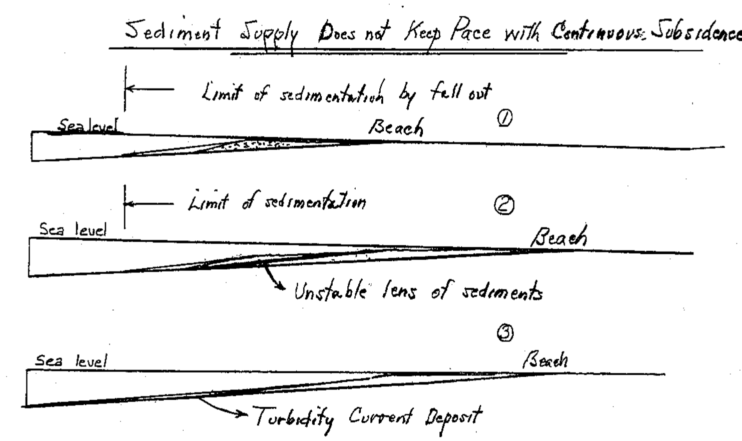

Figure 9. Sediment supply does not keep pace with continuous subsidence.

On a coast where there is a limited supply of sediment, there is not enough sediment to build up a bar that comes to the surface so that an unstable lense of sediment may accumulate out in the water (Figure 8). Now one will ask, why unstable? From evidence, from samples from the Morrocoy wells in the delta, we noted that sediments that are laid down under water do not reach a density of 1.9 until a depth of burial of 500 feet. The sediment above 500 feet is less than 1.9 in density and as low as 1.6, which means that is from 35% to 40% water. If there would be a tremor it may kick that sediment off so that it flows out into deeper water.

Mr. Banks said that turbidity currents have not been observed. In the last number of the National Geographic Magazine there is a vivid description of these deep-ocean divers that went down into the gorges of the Atlantic and, while down, they ran into the wall of one of the channels. They raised so much mud that it started a slide that caused them to be stuck there for 3-4 hourse before they got loose. So, apparently turbidity currents have been observed first hand, and man was the cause.

If there is a limited supply of sediment on a coast that is actively subsiding, then probably a bar will form with a lagoon behind (top diagram, Figure 9). As the floor subsides the sediment becomes unstable and slides off. This process then repeats itself. The question we can ask is, how often does this have to happen to get the thickness of sediments that occur out in the middle of the basin. If the slides are of the dimension that broke the Atlantic cable, they would only have to occur every one or two hundred years to fill up a basin - they do not have to happen every day.

Also to be taken into consideration with respect to the Oficina formation is the source of sediments. On the south side of the Orinoco, the sediments are highly siliceous and there is very little material that could have contributed to shale sediments. There are some schists and granite, which could have gone into shale, but the sediments are predominantly siliceous so that all that could be obtained from these sediments is sand. Therefore the supply of shale material on the south side of the Oficina formation was extremely limited. However, on the north side, the Cretaceous sediments were exposed during the time the Oficina was deposited. Large parts of the Guayuta and the Sta. Anita, and possibly a higher Cretaceous section that might have been present at some time, have been removed by erosion. This eroded sediment is probably the source of the shales in the Oficina formation.

Returning to the types of depostion that we can see in Venezuela, we have the Gulf of Barcelona, with its clean deep water (the Unare river and others dump a considerable amount of material, but it disappears a short distance from shore). The people who took samples of the Cariaco trench got muds, which must have been deposited by some means. The other example is the Gulf of Paria: it is shallow and with dirty water all of the time. The only clear water is near the Boca del Dragón. One can chose between a basin of the Cariaco type, with deep clear water, and evoke some mechanism to get the mud or sediment out there, or one can suppose that the Oficina area was a muddy water area, similar to the Paria Gulf. That muddy water area must have extended from Trinidad westward into Guárico. One can chose either type and find evidence in the Oficina formation to support either view.

MR. J. DESISTO:

I notice that Mr. Dallmus did not take sides on this problem, but I am certainly going to. I do not like the idea of turbidity currents being applied as the mechanism for sedimentation of either the La Pica or the Oficina sediments. When Mr. Passega published his first paper on this subject, I asked myself what evidence did he have to base such an idea. It so happened that I had worked the same fields (Mata Grande and San Roque) that Mr. Passega studied and had noted nothing extraordinary or unusual as to the mode of sedimentation in these two fields and adjacent areas. At the time when this work was done, there were only about 33 wells in Phillips' Mata Grande Field and some 20 Mene Grande wells just to the east - totalling approximately 53 wells - that were available for study to Mr. Passega. Geographically the area involved is very small and bearing in mind the complicated geological history which affected the La Pica sediments - at least two complete cycles of sedimentation each culminating in periods of faulting and widespread erosion, knowledge which can only be derived from detailed regional studies that have never been published - I finally came to the conclusion that Mr. Passega just did not have sufficient information to warrant the introduction of his turbidity current mechanism in the the Santa Bárbara area. This area is complicated indeed and it would necessitate a rather lengthy exposition to outline its various aspects in the various fields and for this reason I would prefer to postpone discussion of the La Pica sedimentation to some later date.

In the San Roque Field essentially the same situation is true. Again, Mr. Passega is handicapped by the very limited area of study. San Roque had at that time only about 23 wells which exposed for study only a partial Oficina section. Of the numerous Oficina sands, Mr. Passega makes detailed studies of only the Colorado "A" and "C" and assumes that all the rest behave the same. It is unfortunate that when Mr. Passega made his study of San Roque, he had no access to detailed maps of Mene Grande's Santa Ana Field (located just to the south) and to the isopach maps of over 50 individual Oficina sands covering an area of over 2000 square kilometers comprising the region commonly referred to as the Greater Oficina Fields. I have prepared sand maps of San Roque, Santa Ana and all areas to the south and east and feel confident that had all this information been available to Mr. Passega, he probably would have reached different conclusions.

I confess that I know little about turbidity currents; however, from what I have been able to read about these phenomena, it would appear that they should leave behind permanent, recognizable, clear evidence which would affect a given section vertically as well as horizontally. It would also appear reasonable to suppose that such effects would be substantial in magnitude, otherwise, they would be difficult if not impossible to differentiate from the products of pure, normal, everyday sedimentation. In short, turbidity currents should produce a clear break in the sedimentation and/or a disruption in the sequence of deposition. I have brought along for your examination several cross sections and five regional isopach maps of Oficina sands which were prepared in 1954. These maps, although out of date, clearly show the fundamental typical characteristics of the occurrence of all the Oficina sands. But before discussing these sections and maps, I wish to briefly review, by way of background, their preparation.

Previous to 1950, attempts were made to correlate and isopach Oficina sands on a regional basis, i.e. covering most of the then-developed fields in the Greater Oficina area. Such attempts were generally plagued with the uncertainty of whether the same correlation and sand nomenclature could be applied on a regional basis in view of the fact that it was noted that although the overall section appeared to be similar from field to field, individual sands were often very difficult if not impossible to pin down.

In 1951, I was given the assignment to re-examine the sand breakdown and the nomenclature of the complete Oficina Formation and to recorrelate all the wells in the area just east of Guere Field eastwards to the Pelayo area, and from south of Oveja Field northwards to the Cantaura area. Within this region were over 2000 wells. The first step was to make a series of east-west and north-south intersecting regional cross sections which served to (1) delineate regionally-developed lithologic units, (2) permit a more uniform and more detailed sand nomenclature and (3) control the extension of the system in all directions. It was found that the complete Oficina Formation could be divided into 93 different sand units of regional occurrence. All these sand units and the intervening shales are generally present in a normal section from as far south as well control exists to north of Santa Rosa Field. Obviously, there is a great but gradual expansion of section from south to north (basinward) which often confuses the correlation wherever control is widely separated; however, invariably when closer control becomes available, the correlation breaks down into the established lithologic breakdown. Also, although the Anaco correlation, applicable to all fields in the Anaco trend (Toco, Santa Ana, San Roque, San Joaquín, El Roble and Santa Rosa) appears completely different from the so-called Oficina correlation used in all fields in the Greater Oficina area, it is possible to name any given Oficina sand using either of the two nomenclatures. This has greatly simplified the understanding of the regional character and occurrence of sands in the Oficina Formation. It made definitely clear that there are no interruptions in the vertical sequence of sedimentation throughout the Oficina Formation within the area indicated. This condition would not likely be the case if this area had been subjected to other than just normal sedimentation or the effects of significant turbidity currents.

After the regional correlation was completed, isopach maps were made of each of the 93 different sands that comprise the Oficina Formation. A study of these maps revealed some very important aspects of the sedimentation during Oficina time. Overall, it can be said that the southern and the middle two-thirds of the area studied received abundant sands; the section becomes shalier in the western part and, in the northeastern quadrant, the entire upper Oficina section down th the lower "E" sands is shaled out. This shaling out process is gradual and takes place from a west to east and from south to north direction. The sedimentary trends of all sands are oriented north-south, or nearly so (see Figure 10). This feature is both geologically as well as economically important. It is geologically interesting because it indicates the direction of transportation of sediments - from the Guayana Shield area on the south into an east-west trending embayment on the north. Many sands are developed as narrow channel-like features shaling out to the east and west. Others have a thin sheet-like background on which are superimposed thick, narrow bodies of sand suggesting coalescing channel trends. Most sands in the lower three-fourths of the section are closely allied with lignites. These lignites may be found at the base, at the top or within a sand body. Often, wherever a particular sand is shaled out, the lignite persists at its correct position in the section, thus, they are highly valued as correlation aids. Generally thick trends of a given sand are not likely to be superimposed on similar thick trends of an adjacent sand, or even a nearby sand; there is always some lateral shifting. However, in any given area there is considerable compensation of section and it is generally found that the total thickness of given zone remains nearly constant if proper correction is made for regional basinward dip. All sands shale out somewhere within the area studied. Whether these sands are

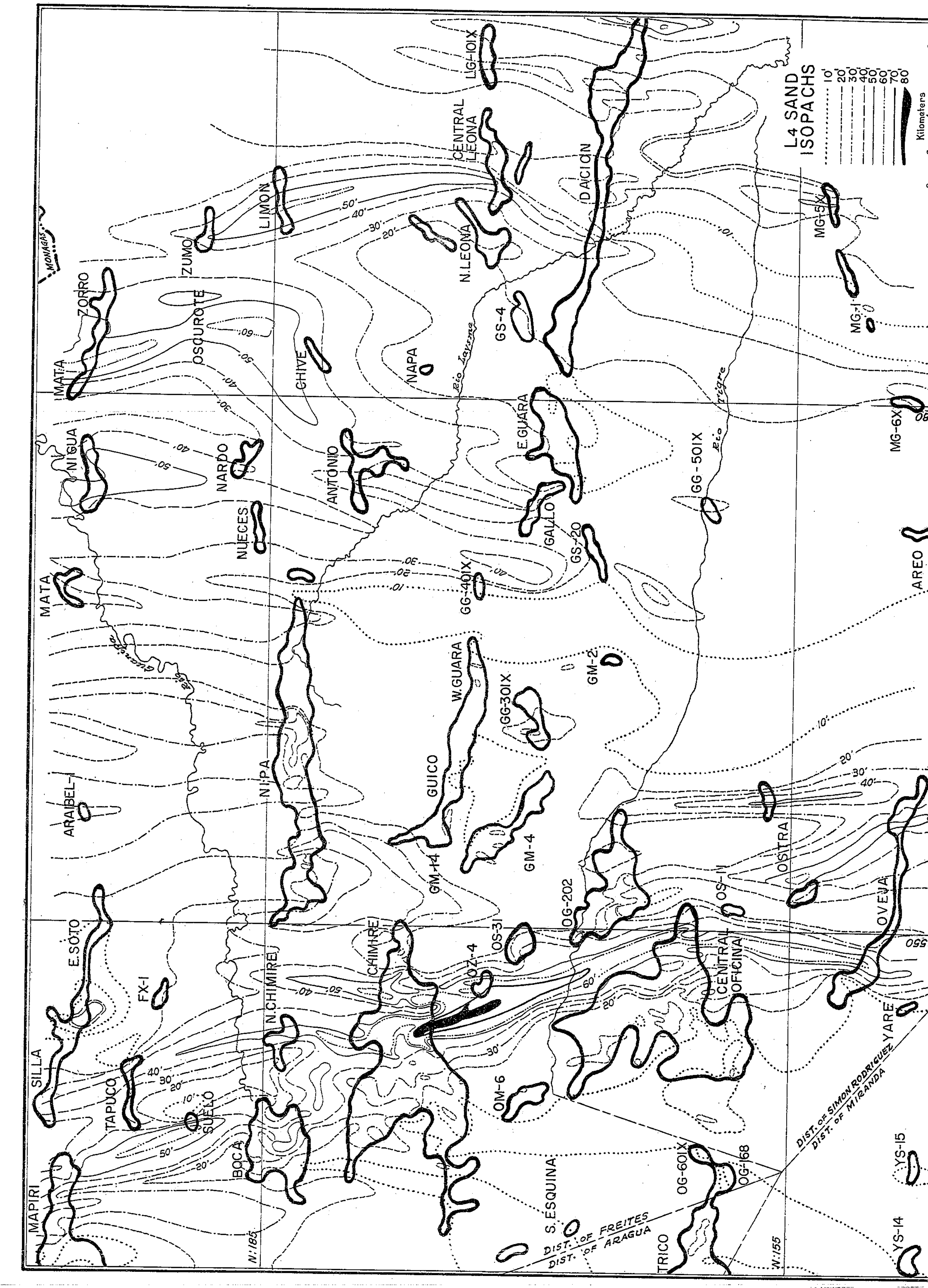

Figure 10. Isopach map of the L_4 sand, Oficina formation, in the Greater Oficina Area

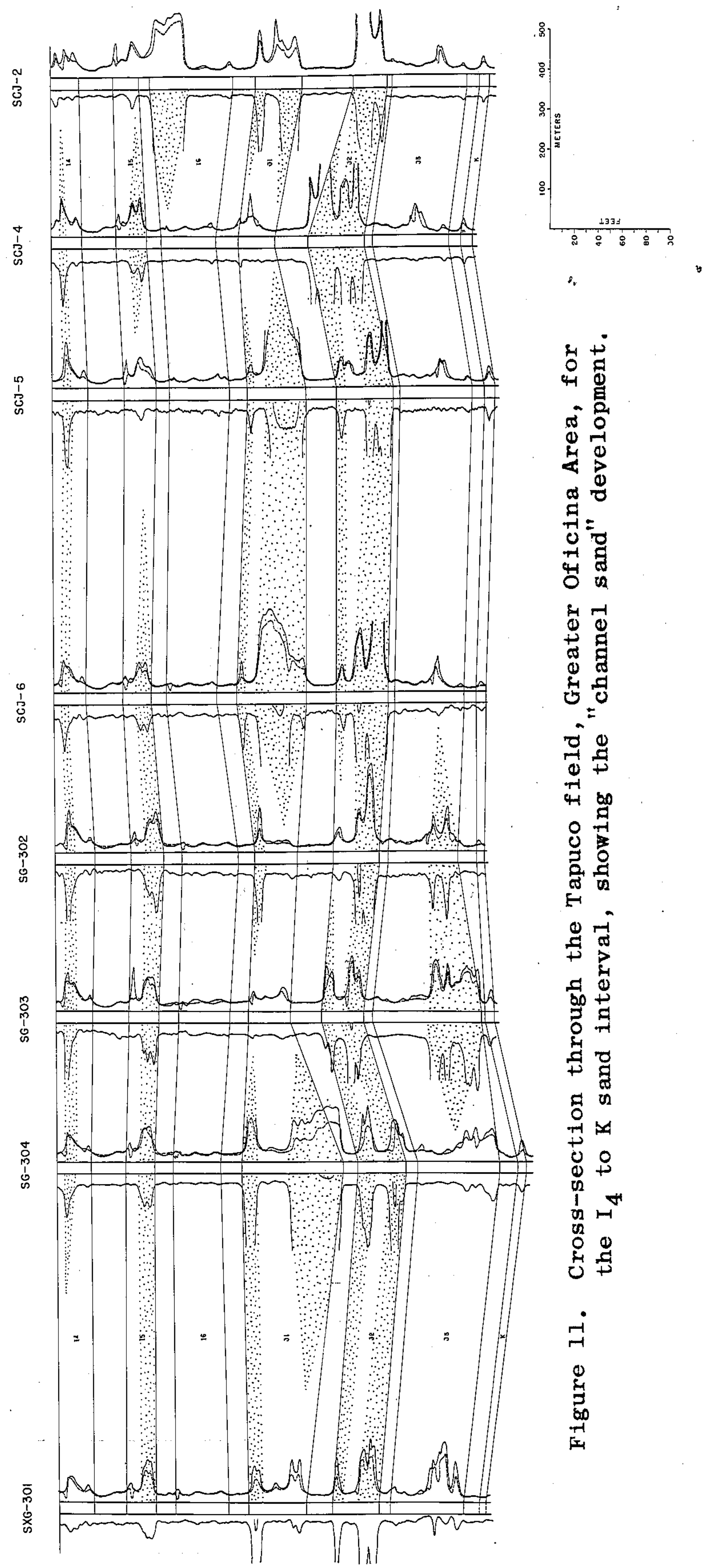

Figure 11. Cross-section through the Tapuco field, Greater Oficina Area, for the I_4 to K sand interval, showing the "channel sand" development.

the blanket type or the channel type, they generally will silt-out and finally shale-out in a given direction. The shale-out lines of all sands are generally oriented north-south or approximately so. This occurrence often controls or aids oil accumulation and together with the numerous east-west faults which cut across north-south trending channel trends, are the most important geological features that have made the Greater Oficina region extremely attractive economically.

Numerous cross sections have been made in various parts of the area under consideration, particularly across channel trends. These sections (see Figure 11) generally show: (1) no scouring from underneath channel sand bodies; a given sand is not likely to even merge with its underlying or overlying neighboring sand, although there are some exceptions to this case; (2) buried erosional troughs such as the sides and bottom of river channels have never been observed: (3) a given sand will generally silt-out before shale-out laterally; (4) any sand may appear or disappear anywhere on the map, so that it is not correct to assume that in the southern part of the map (closer to the source) there is likely to be a greater amount of sand; (5) there is generally a structural loss in position of the horizons immediately below a channel sand, or a structural gain in position of horizons below but adjacent to channel sand bodies; and (6) the thickness of a shale zone separating two sand units - whether of the channel or blanket type - is likely to remain constant and will vary only with regional dip.

The above observations suggest that the area covered by the maps was apparently low, shallow, protected from marine erosive agents and with abundant vegetation. It had many interconnecting water bodies of varying sizes and the main streams flowed from the south to north. These conditions are not unlike the extensive present-day Orinoco delta, with the main difference that here the river system flows predominantly east instead of north. Thus, it is difficult to visualize turbidity currents in operation in an area where the predominant geological data suggest quiet normal sedimentation and, for the most part, completely devoid of destructive erosional factors of any kind.

(Editor's note: Several sand isopach maps and cross-sections were shown and discussed in detail. Unfortunately the reduction of these maps and sections proved too difficult, so only one of each is included in the bulletin.)

DISCUSION ABIERTA

LMB: In regard to the warning by Dallmus that one should not accept or offer an authority's opinion as fact, I would like to say that I have long since learned not to take somebody else's word for granted. However, the body of facts I have offered does not represent opinion or "opiniated" observations but rather basic facts that have been gathered by means of accepted technical methods of observation. For obvious reasons, I have not made all 12 observations myself. Items 1, 2, 7, 8, 9 and 11 have been handed down to me by paleontologists and geologists whose observations I have no reason to impugn. In turn, I would suggest that one should not confuse interpreted fact with pure and simple observation or fact.

GG: Wouldn't there have to be considerable vertical oscillation of the coast line in order to account for the alternation of lignites, sandstones and shales if they were deposited in different environments.

GAY: As shown by the work of Van Andel and Postma (1954) on the Gulf of Paria, every tide raises the water-level considerably throughout the delta area (about 2 meters near Boca Vagre) and thereby causes a change in the type of sediment locally, permitting thin layers of muds to be deposited in the swamps, and silts and sands to be deposited near the edges of the natural borders of the caños and streams. Bottom currents carry between 100 to 200 mg/liter of suspended sediment. In that way the tides alone produce significant variation without the necessity of rapid earth oscillation.

GG: I believe that the thicknesses of the various sediments are greater than those that would be caused by tides; the Oficina sediments are not thin varves.

GAY: I don't believe that the tidal variation would necessarily cause varve-like deposits, but rather a certain thickness of the same type of sediments. Then a major change would take place due to changes in stream-course or general submergence. However, within historical times, there have been notable examples of repeated submergence and emergence; for example, the famous ups and downs of the coast of Greece as indicated by the fossils on the marble columns. In this case there were several feet of difference.

GG: It is not just the matter of a coastline oscillating up and down, but rather, for the area of the Oficina formation, the oscillation of a large area undergoing submergences and emergences.

KFD: Does anyone know of wells drilled in present-day deltas that show continuity of sediments both laterally and up-and-down dip - I don't know of a single case where one can even trace a bed for a mile by the electric log where the well is in a present-day delta.

GAY: I have been trying to investigate that point in the Delta Amacuro, and I found that the upper 200 feet of sands and lignites in some of the wells (in Tucupita field) can be traced. Unfortunately there are not very many wells in the delta area, and most are not logged in the uppermost 200 feet of section.

KFD: In all of the wells that I know about in the Las Piedras formation, one can't correlate anything - except one shale bed.

FWJ: How about correlation in Quiriquire?

KFD: There are some shales that are correlatable.

FWJ: One can correlate many of the intermediate beds or sands also, and on a map of one of the sand-intervals, one can see a channel sand development similar to that of the Oficina area.

JDS: I have made similar maps in the Las Piedras formation of the Sta. Bárbara area.

KFD: How far can you correlate: 1 km, 5 kms?

JDS: One location with certainty, and with favorable development of shale bed, over a considerable distance.

KFD: One location! All right, the type of sedimentation in Oficina can be correlated for 50 kms, both along the strike and up-and-sown dip, which is an entirely different dimension.

JDS: How about correlation in the swamp deposits of southern Florida, where one has essentially the same type of deposition as in the Oficina.

KFD: That swamp is resting on coral and limestone deposits.

GAY: Mr. Spackman (March 1958) recently pointed out that there were four major swamp environments encountered in tropical Florida: a) the fringe marine environment dominated by <u>mangle</u>; b) the brackish Everglades environment dominated by sedges; c) the stream-side environment with mixed angiospermous vegetation, and 4) the palm-mixed hardwood hammocks. In each of these environments a characteristic type of peat is forming and these peat types represent the identifiable and correlative lithotypes in later developed lignites and coals. He mentions that in view of the size of the areas covered by major coastal plain swamp environments, it is easy to understand why most lignites are composed of several lithotypes, each having considerable lateral extent.

Another question of fact: how continuous are the "blanket" beds? In the case of the lignites, certain sections, such as the H sands, always contain five or six lignites, but are they really the same from one field to the next? I don't believe they are, because the number, stratigraphic position and sand-shale relationship varies over large distances. The shales are undoubtedly extensive as an interval, but each shale also varies in thickness and in the number of siltstone beds. Even in the example of a blanket shale given by Figure 3, the character of the shale changes from field to field. Many of the sands are obviously not continuous, only the sand-interval is laterally extensive. Now, the reason for questioning this fact of "blanketness" is that blanket beds are being mentioned as possible evidence for turbidity currents. Thus, within a field a lignite or shale may be considered as having the same characteristics, but this may be due to normal coastal plain swamp and delta deposition as in Florida, not to turbidity currents.

LMB: (Statements on deep water, graded bedding and pelagic faunas.)

(Editor's note: the discussion continued but unfortunately was not recorded.)

Participants:

LMB - L. M. Banks	GG - G. Graves
KFD - K. F. Dallmus	FWJ - F.W. Johnson
JDS - J. DeSisto	GAY - G.A. Young

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NOTICIAS

Afiliación de la Asociación con la AAPG

En la reunión de la AAPG, del 13 de mayo de 1958, ante la recomendación del comité ejecutivo, se votó a favor de la afiliación de la Asociación Venezolana de Geología, Minería y Petróleo a la AAPG.

Representantes de los organismos

En la reunión de la Junta Directiva, del 4 de julio de 1958, se vió la necesidad de nombrar a un representante por cada compañía petrolera y instituto ante la Asociación. Dicho representante desempeñará las funciones de distribución del boletín y avisos, cobro de cuotas anuales, etc.

Los representantes nombrados son:

Alberding	(Signal)
Beaver	(Petro-Tech)
Christian	(Pan-Ven)
Claret	(Surenco)
Dumestre	(Pan Coastal)
Johnson	(Creole)
Laubscher	(Socony)
Mas Vall	(Min. Minas e Hidr.)
Moore	(Shell)
MacFarquhar	(Sinclair - Sta. Bárbara)
Merrill	(Martin, Sykes)
Nicolai	(Superior)
Lesser	(Continental)
Rickards	(Phillips)
Rod	(Atlantic)
Shriner	(Texas)
Simmons	(Sun)
Szenk	(Mene Grande)
White	(Richmond)

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