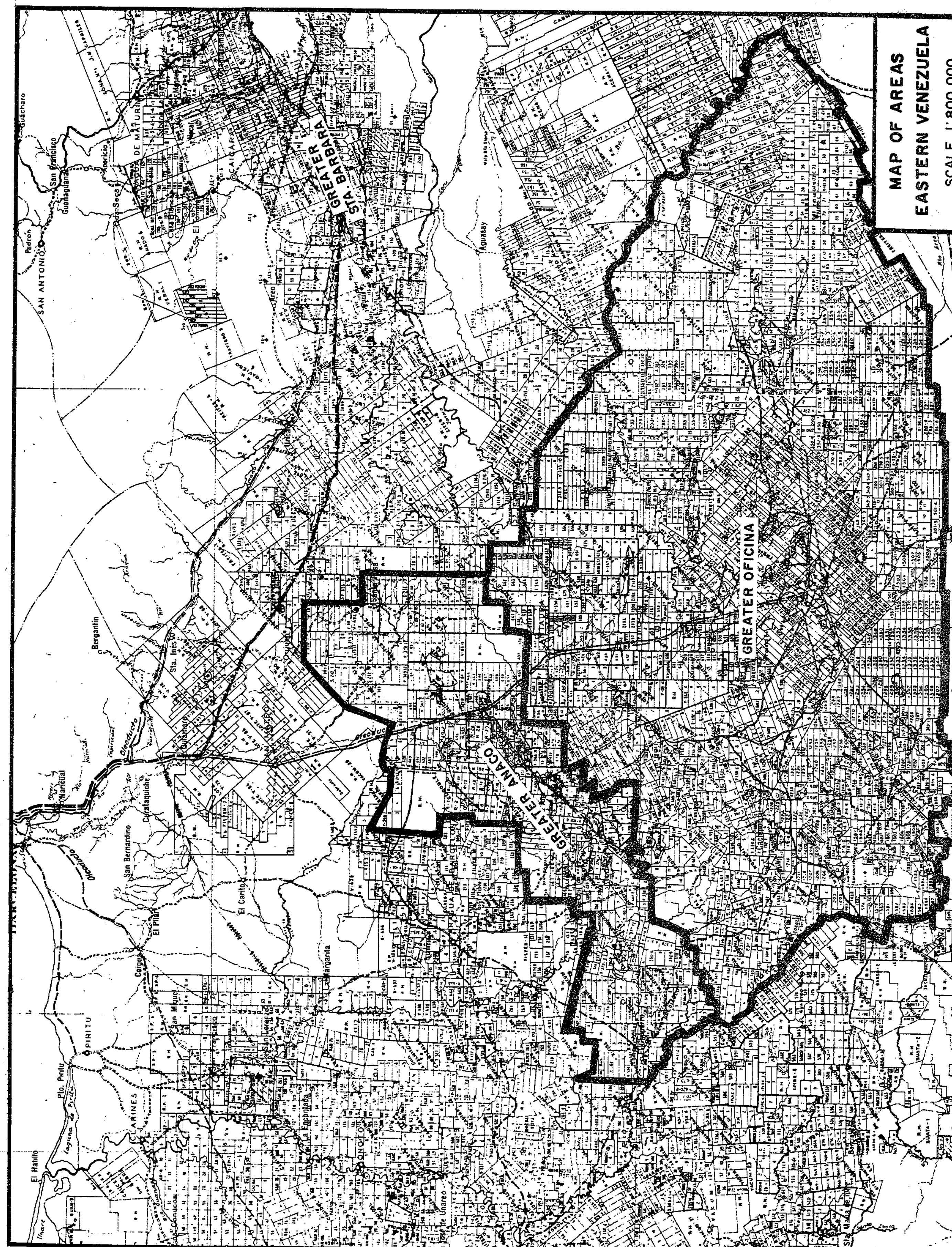

De Sisto. Location map of the Eastern Venezuelan Basin showing the location of the Anaco and Oficina types of sand nomenclature of the Oficina formation.

CONFERENCIA

CORRELATION OF THE OFICINA AND ANACO TYPE SAND NOMENCLATURE OF THE OFICINA FORMATION[1]

by John DeSisto[2]

In Eastern Venezuela, there are two extensive, productive formations, the sand sections of which are subdivided and named differently within their respective areas of occurrence. One is the La Pica formation, which is productive in all the fields of the Greater Santa Bárbara area. If one were to pick up a log from Phillip's Mata Grande Field or Mene Grande's West Travieso Field, one would find the complete sand section subdivided into 33 units designated W-1 to W-33, whereas a log from Mene Grande's East Travieso Field would show sand subdivisions called A-1, 2, 3, 4, 5, B-1, 2, 3, C-1, 2, 3, 4, T-1 to T-15. A little farther east, any of Sinclair's logs would indicate the A, B, C, D, E, sands and a series of "L" sands. If one moved over to Creole's Mulata Field, one would see the sand section subdivided into the S-1, 2, 3, 4, 5 and from J-1 to J-22 sands. All these various sand nomenclatures designate essentially the same (or a similar) sand section!

The other formation having multiple sand nomenclatures is the Oficina formation, which is productive in all the fields of the Greater Oficina and Greater Anaco areas. The so-called Anaco correlation is in common usage in the Toco, Santa Ana, San Roque, San Joaquín, Guario, Roble, and Santa Rosa fields and all other wells to the west and north of these fields. The Oficina correlation is used in all fields south and southeast from the Greater Anaco fields. It is the purpose of this discussion to demonstrate the inter-relationship of these two widely used sand nomenclatures.

A glance at the location map (Figure 1) will place the geographical position of these areas. It is noted that in relation to the Eastern Venezuelan Basin, the Greater Oficina fields occupy an updip location and the Greater Anaco fields are far downdip. This relationship is important to keep in mind because it really is one of the principal reasons why the two nomenclatures were devised. In all updip areas, the Oficina formation is generally thinned out. It thickens gradually to the north (downdip) and in the area of the Greater Anaco, it may be as much as two to three times as thick as in Oficina Field.

Drilling activity commenced in the Oficina and Anaco areas at approximately the same time. Oficina No. 1 was drilled in 1933 and completed in 1937. Other nearby wells, Areo-1, Oficina-2, Merey-1 and Tigre-1, were drilled during 1936-1937. These wells established the Oficina type of sand breadkown and nomenclature. Approximately 60 kilometers northwest, AM-1 was drilled on the Santa Ana Dome in 1936. Continuous cores were taken and a study of these cores by the Mene Grande laboratory established

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[1] Presented before the Asociación en el Salón de Actos, Colegio de Ingenieros de Venezuela, on 17 February 1959. Manuscript received 5 March 1959. Published by permission of the Mene Grande Oil Co., Creole Petroleum Corp. and the Texas Petroleum Co.

[2] Mene Grande Oil Co., Caracas.

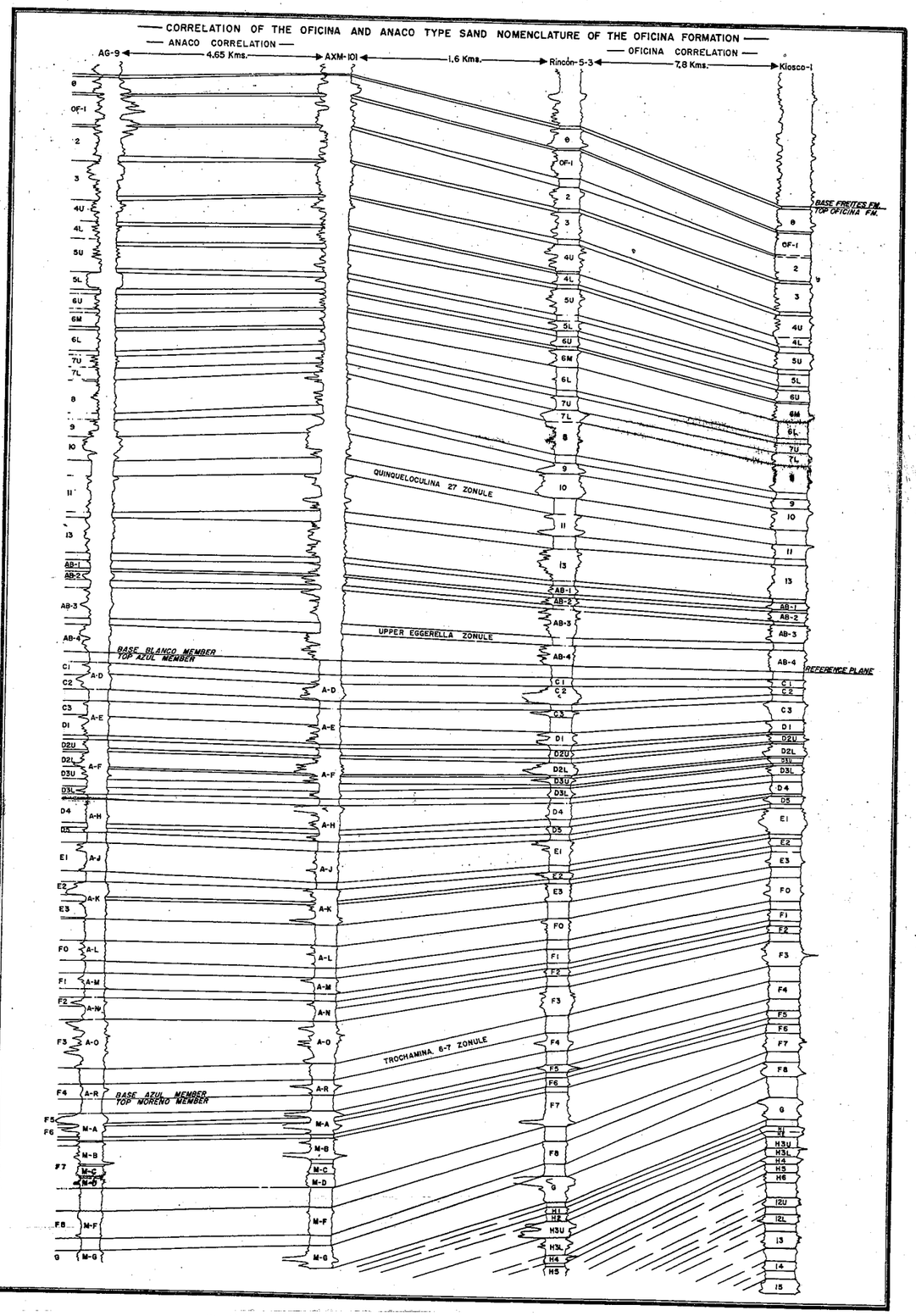

Fig. 2 DeSisto. Comparison of the two nomenclatures in the upper Oficina formation, illustrated on the electric log cross-section AG-9 to Kiosco-1.

a general paleontologic correlation with the wells of the Oficina area.[1] No correlation could be made on a sand-by-sand basis, so consequently a completely different sand nomenclature was originated.

Soon after the drilling of these early wells, exploration and exploitation progressed rapidly. New productive areas were discovered progressively downdip from Oficina Field and along the Anaco trend. An attempt was made to tie-in each new field with the nearest area of control and generally no serious difficulties arose except that some uncertainties in the correlation began to creep in for most outlying areas. These uncertainties were later checked and corrected as more well control became available throughout the area. Finally with the drilling of Kiosco-1, Rincon 5-1, 2, 3 and AXM-101 in 1953, close enough control was afforded to be able to tie-in the Anaco and Oficina systems of sand nomenclature on a sand-by-sand basis. The results are shown by Figures 2, 3 and 4 and are summarized on Table No. 1.

Figures 2, 3 and 4 are correlation sections of the complete Oficina formation from AG-9, located in the northeastern part of the Santa Ana Field, through AXM-101, Rincon 5-3 and Kiosco-1. The distance between these four wells is 4.65, 1.6 and 7.8 kilometers respectively. The sections are drawn with a vertical scale of 1:4000 and with no horizontal scale. The logs of AXM-101 and Rincon 5-3 are faulted; however, the missing sections have been replaced by ones taken from a nearby well and for this reason these two logs may be considered as composite logs. Kiosco-1 and Rincon 5-3 show the typical Oficina sand breakdown and nomenclature, whereas AXM-101 and Ag-9 show the Anaco system of sand nomenclature.

Figure 2 is a section drawn with the base of the AB-4, or the base of the Blanco Member, as reference plane. This section shows the sand development, sand breakdown and sand nomenclature of the upper part of the Oficina formation. As noted, in the Anaco system the topmost sand named is the Azul-D, which correlates with the C_1 and C_2 of the Oficina system. The Azul-D sand is the topmost sand that can be correlated regionally with ease in the Greater Anaco area. Along the line of this particular section, it is not too difficult to correlate with certainty the section above the Azul-D (or the C_{1-2}) through the Oficina-6 sands. Above this point to the top of the Oficina formation, the correlation is admittedly only approximate. Inability to tie down exactly the uppermost sands of the Oficina formation is a regional characteristic and the fundamental reason is that this portion of the section generally lacks well defined shale units of regional occurrence. The various sands are therefore subdivided mainly on the basis of interval thickness. The topmost marker found over a fairly large area in the Greater Oficina region is a lignite that generally occurs between the Oficina-5_u and 5_L sands. Above this one lignite may occur other lignites but these have very local distribution and are not of much use in a regional correlation. The shale unit separating the Oficina-6_L and 7_u is of regional significance. The Oficina-7_u and 7_L sands are divided mainly on the basis of a shale break or a lignite that frequently occurs near the base of the 7_u. The Oficina 7_u, 7_L and 8 are correlated mostly on superposition and interval thickness. The shale bed between the Oficina-8 and 9 sands and between the Oficina-10 and 11 sands are of regional occurrence and therefore important correlation markers. Given a blank, random log from anywhere in the Greater Oficina area, it is very often best to begin the correlation at this point. Within or near the shale unit separating the Oficina-10 and 11 sands occurs the topmost fossil horizon, the Quinqueloculina-27 zonule, of the Oficina formation. The Mene Grande laboratory reports that this hori-

[1] "Anaco Fields, Central Anzoátegui, Venezuela" by H. J. Funkhouser, L. C. Sass and H. D. Hedberg; AAPG vol. 34, No. 10, 1948; page 1858.

zon is of regional importance. The Oficina-11 and 13 sands generally lack persistent, distinctive log characteristics, however, they cause little difficulty in the correlation since they are set off at the top and bottom by regional shales. In the Mene Grande nomenclature the Oficina-12 sand does not exist; this interval was originally set aside for thin sand or sands near the base of the Oficina-11 sand as it occurs in the Chimire area; however, regionally it was found to merge with the base of the Oficina-11 sand. The shale unit indicated between the Oficina-11 and 13 sand is of semi-regional occurrence. It is present in all downdip areas and through most of the Greater Oficina fields but in the southeastern part, it is often absent. The AB-1 and AB-2 sands are generally thin sands separated by a thin shale and overlie a much thicker AB-3 sand. The shale unit between the AB-2 and AB-3 is generally easier to carry cross country than the shale between the AB-1 and AB-2. At least one or more lignites are often observed near the middle of the AB-3. The Upper Eggerella Zonule is the second important fossil horizon of the upper Oficina formation and it generally comes in at or near the regional shale bed separating the AB-3 and AB-4 sands. The AB-4 sand, unless shaled out, is distinctive everywhere since it is sandwiched between two regional shales. The base of the AB-4 is also the base of the Blanco and the top of the Azul Members of the Anaco system of nomenclature. Of the three C sands originally defined in the Greater Oficina area, the C-1 and C-3 are only of local importance, generally shaling out over wide areas or represented merely by silt streaks. The C-2, correlating with the lower half of the Azul-D interval, can be traced regionally. At or near the base of the C-2 occurs a persistent lignite. Between the C and D sands is another shale bed of regional development. The D_1 sand is either shaled out or a poor sand over much of the Greater Oficina region, but in downdip areas, it is a distinctive interval, which correlates with the lower part of the Azul-E sand. The D_{2u} and D_{2L} sands, representing roughly the upper half of the Azul-F sand, are generally subdivided on the basis of a distinctive lignite located at the base of the D_{2u}. The D_{3u} and D_{3L} are correlated regionally mainly on the basis of superposition and interval thickness. Together they check with the lower half of the Azul-F interval. The shale between the D_{3L} and D_4 is of regional occurrence. The D_4 generally consists of two or more related sands and is set off at the top and base by thin but persistent shales. The D_4 correlates with most of the Azul-H interval. The D_5 is thin and of minor importance through most of the Greater Oficina area. It correlates with the basal part of the Azul-H. The E_1 correlates with the Azul-J. Good shale breaks are generally present at the top and bottom of this sand. The E_2 and E_3 together check with the Azul-K interval. Usually there is a thin shale break between the E_2 and E_3, but over much of the Greater Oficina area, these two sands are closely related and some difficulty may be experienced in their correlation. One of the most widespread lignites occurring in this portion of the Oficina formation is observed at the base of the E_3 sand. The Fo sand correlates with the Azul-L. Above and below the Fo are shale beds of regional character. The F_1 sand generally creates no correlation problems; it apparently is the same as the Azul-M sand. The F_2 is a thin sand correlating with the upper part of the Azul-N interval. The F_3 is easily recognized almost everywhere and correlates with the Azul-O sand of the Anaco system. Near the middle or upper part of this sand, one or more lignites may generally be observed. The Trochammina 6-7 zonule typically comes in at or near the thick regional shale bed separating the F_3 and F_4 sands. The F_4 sand checks with the Azul-R. Both are easily correlated since they set off by thick regional shale beds. The base of the F_4 (or the Azul-R) is the base of the Azul and the top of the Moreno Members. The F_5 and F_6 sands are generally difficult to carry on a regional basis because they (particularly the F_6) are somewhat variable. Over much of the Greater Oficina area the F_6 is shaled out. The F_5 and F_6 together correlate with the Moreno-A sand. The F7 sand is probably the most variable interval of the whole Oficina formation in respect to thickness or net sand content. Fortunately it rests on a regional shale so that its correlation

CORRELATION OF THE OFICINA AND ANACO TYPE SAND NOMENCLATURE OF THE OFICINA FORMATION

Oficina Correlation	Anaco Correlation	Oficina Correlation	Anaco Correlation
Base AB_4	Top Azul Member	L_{1L}	$N\text{-}H_3$
$C_{1\text{-}2}$	Azul-D sd	L_{2u}	N-I
$C_3\text{-}D_1$	" E	L_{2m} & L	$N\text{-}J_2$
D_{2u} - D_{3L}	" F	L_3	$N\text{-}K_{1\text{-}2\text{-}3}$
D_{4u} - D_5	" H	L_4	$N\text{-}L_{1\text{-}2}$
E_{1u} & E_{1L}	" J	±20' below L_4	Top Verde Member
E_2 - E_3	" K	M_1	Verde-$A_{1\text{-}2\text{-}3}$
F_o	" L	M_2	Verde-$B_{1\text{-}2}$
F_1	" M	M_3	Upper Verde-B_3
F_2	" N	M_4	Lower V-B_3 & V-C_2
F_3	" O	N_{1u}	Verde-$D_{1\text{-}2}$
F_4	" R	N_{1L}	Verde-$E_{1\text{-}2}$
Base F_4 sd	Top Moreno Member	N_2	Verde-$F_{1\text{-}2}$
F_5	Moreno-A	O_1	Verde-G & H
F_6	Lower M-A & Upper M-B	O_2	Verde-I & J
F_7	Lower M-B, M-C & M-D	Base O_2 sd	Top Amarillo
F_8	M-F	P_1	Amarillo-$A_{1\text{-}2}$, B_1
G	M-G	P_2	Nearly all of A-C
H_1 - H_2	M-H	P_3	Basal A-C & A-D_2
H_{3u}	M-I	R_o	A-$E_{1\text{-}2}$
H_{3L}	M-J	R_1	A-$F_{1\text{-}2}$ & upper G
H_4 - H_5	M-K	R_2	A-H,K,L,Col-$A_{1\text{-}2}$
H_6	Below M-K	Shale near base of R_2	Top Colorado Member
I_{2u}	M-Q	R_3	Col-B_1 & upper C
I_{2L}	M-S	R_{4u}	Col-$D_{1\text{-}2}$
I_3	M-U	R_{4L}	Col-$E_{1\text{-}2}$ & $F_{1\text{-}2}$
Base I_3 sd	Near Top Naranja Member	S_1	Col-G
I_4	N-B	S_2	Col-H-I
I_5	$N\text{-}C_1$	S_3	Col-K-L
I_6	$N\text{-}C_5$ & N-D	S_4	Col-M_1
J_1	N-E	S_5	Col-M_2
J_2	$N\text{-}F_{1\text{-}2}$	T_u	Col-$N_{1\text{-}2}$ & P_1
J_3	$N\text{-}F_{5\text{-}6}$	T_L	Col-$P_{2\text{-}3}$
L_{1u}	$N\text{-}H_1$	U_1	Col-$R_{1\text{-}2}$

Table I. DeSisto

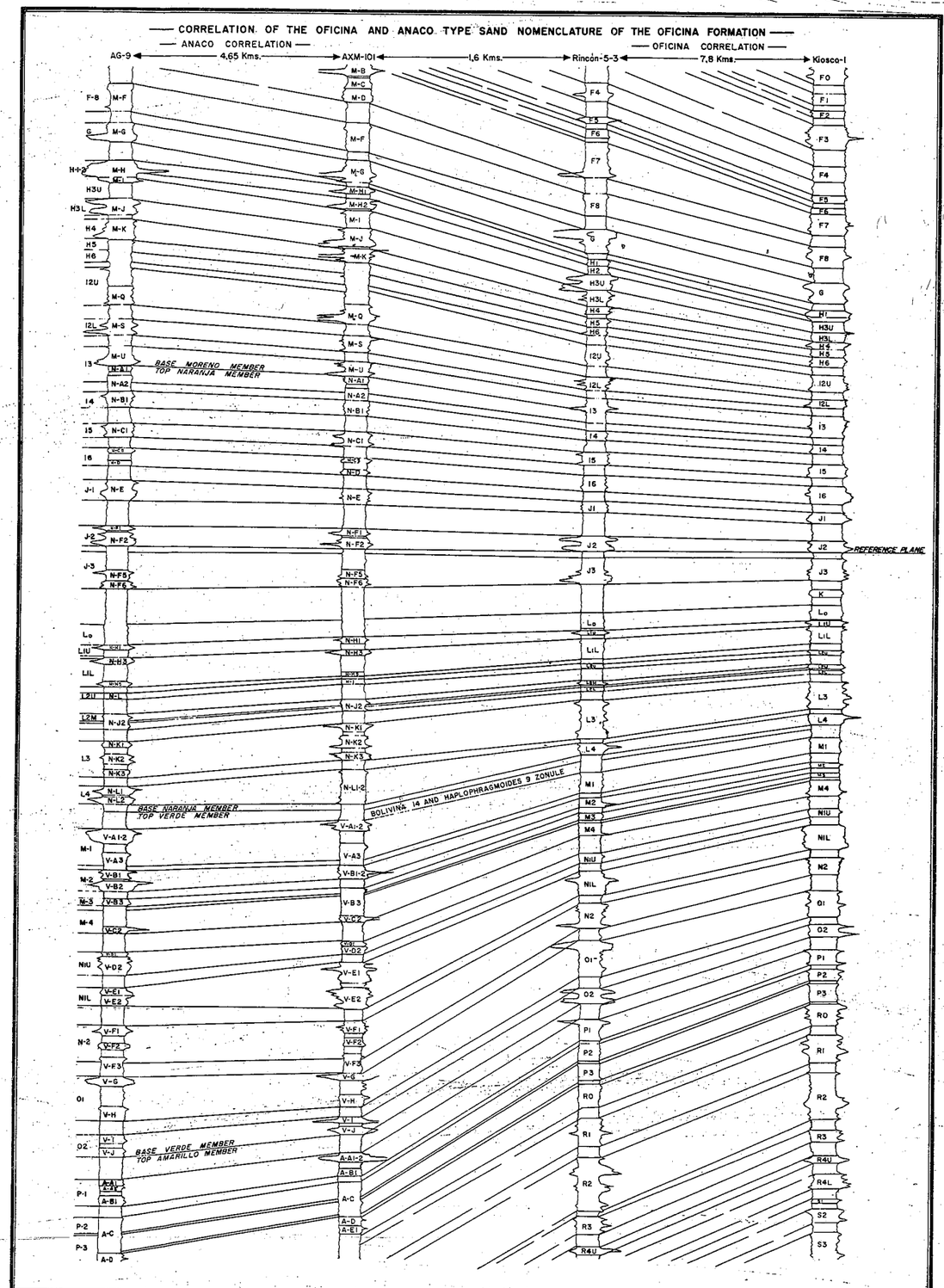

Fig. 3 De Sisto. Comparison of the two nomenclatures in the middle Oficina formation, illustrated on the electric log cross-section AG-9 to Kiosco-1.

is generally not difficult. The F_7 correlates with the Moreno-B, C and D sands of the Anaco system. The F_8 correlates with the Moreno-F. The F_8 is generally not an easy sand to carry cross country because it shales out over wide areas and, at places, it apparently merges with the lower part of the F_7 sand. Between the F_8 and G sand always occurs a thick regional shale greatly aiding the correlation of this portion of the section.

Figure 3 shows the correlation of the sands and shales of the middle Oficina formation. Continuing the sequence down the section, we find the G sand as equivalent to the Moreno-G of the Anaco system. The H sands are not well developed in Kiosco-1 nor at Rincon 5-3, nevertheless, the interval appears to correlate with the Moreno-H to just below the Moreno-K sands. In most of the Greater Oficina fields, the H sands are separated on the basis of lignites. Ideally there should be at least one lignite for each sand with the exception of the H_5, however, some difficulty arises when some of the lignites are absent. The most persistent lignites are: one near the top of the H_{3L}, another near the base of the H_4 and another at or near the base of the H_6. Near the H_1 and H_2 are often one or two lignites of wide distribution. The H_{3u} is shaled out over wide areas. The I_{2u} correlates with the Moreno-Q and some of the silt and shale just above. The I_{2L} checks very well with the Moreno-S sand. In all downdip areas no difficulty is ever experienced separating the I_{2u} from the I_{2L} but in some updip regions these two sands have a tendency to merge or the I_{2u} shaleout makes their exact separation locally doubtful. The I_3 sand correlates with the Moreno-U sand. Its base is also the base of the Moreno Member and the top of the Naranja Member. A lignite of very wide distribution is found typically at the base of the I_3 sand. The I_4 generally is a thin sand or silty shale zone between two regional shales and apparently correlates with the Naranja-B_1 sand. The I_5 and I_6 have a similar occurrence. The separation is further aided by the presence of a widespread lignite occurring near the top of the I_6. The I_5 correlates with the Naranja-C_1 while the I_6 is believed to be represented by the Naranja-C_5 and D sands. The J_1 sand, correlatable with the Naranja-E, is separated from the section above and below by regional shales. The J_2 is a persistent interval through the Greater Oficina area and is generally closely related with the underlying J_3. The separation is a thin shale often aided by the presence of one or more lignites within the J_2 or close to its base. The J_2 correlates with the Naranja F_{1-2} sands. The J_3 correlates from just below the Naranja-F_2 through the Naranja-F_6 sand. Over much of the central, western and northern Greater Oficina region, the section from the base of the J_3 to the L sands is a shale. Locally the K sand makes its appearance and its typical position is shown by the log of Kiosco-1. The L_o more often than not is simply a silty shale; sands in this interval are generally very local. In many areas, there is a lignite at or near the base of the L_o. The L_{1u}, except when locally expanded, is generally a thin sand which correlates with the Naranja-H_1 interval. The L_{1L} comprises the section from the Naranja-H_3 through the H_5. Below the L_{1L} is generally a thin widespread shale. The L_{2u} is generally a poor thin sand which often shales out but it is one of the best correlation markers within this portion of the Oficina formation. A persistent lignite is observed at or near the base of this sand which keeps its exact stratigraphic position even when the sand is shaled out. The L_{2u} is believed to correlate with the Naranja-L. Over wide areas, the L_{2m} and L_{2L} are not good sands but they can be identified on a regional basis and correlate with the Naranja-J_2 sand. The L_3 is usually one of the thicker units in this part of the section and generally presents no correlation problems. A thin but persistent shale separates the L_3 from the L_4. Near the top of the L_4 or at the base of the L_3 may often be found one or more lignites. The L_3 and L_4 correlate with the Naranja-K and L respectively. A regional shale occurs between the L_4 and M_1. Near the top of this shale, generally about 20 feet below the base of the Naranja-L_2, is

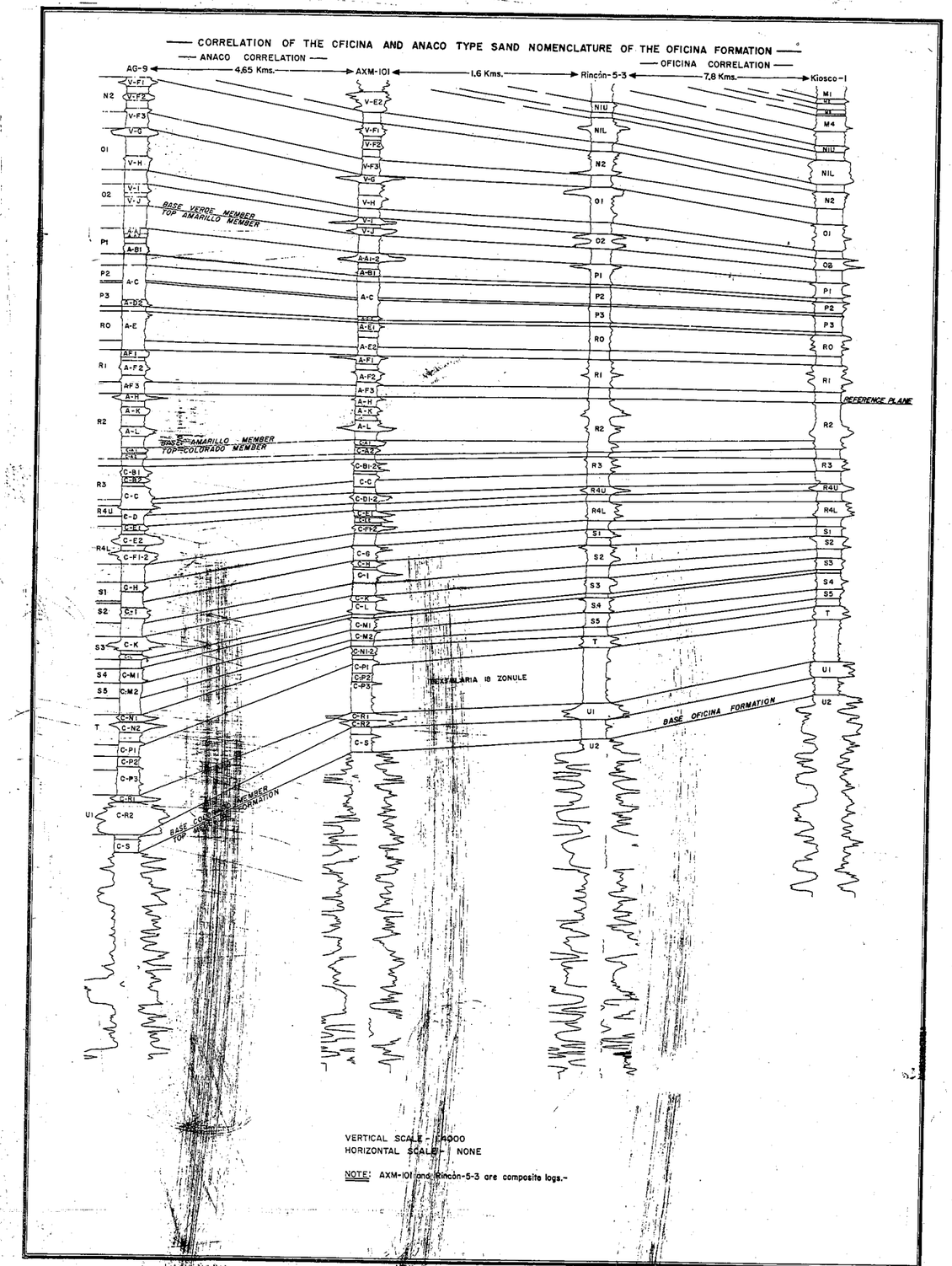

Fig. 4 DeSisto. Comparison of the two nomenclatures in the lower Oficina formation, illustrated on the electric log cross-section AG-9 to Kiosco-1.

the base of the Naranja and the top of the Verde Members. The laboratory reports that the Bolivina-14 and the Haplophragmoides-9 zonule makes its appearance at or close to this shale. As shown by Figure 3, the M_1 sand is shaled out at Kiosco-1 and at Rincon 5-3, however, regionally this sand has a widespread occurrence. One or more lignites are often present near the base of the M_1. This sand correlates with the Verde-A_{1-2-3}. The correlation of the M_2 and M_3, which are usually thin intervals, is aided by the presence of a lignite frequently associated with the upper M_3 sand. The M_2 and M_3 correlate with the Verde-B_{1-2} and Verde B_3 respectively. The M_4 rests on a thick regional shale. This sand shales out over wide areas but its interval is preserved by a silty shale easily recognizable on all logs. The M_4 checks with the Verde-C_2 and the shale just above. The sand marked N_{1u} in Figure 2 shales out over much of the Greater Oficina region. The N_{1L} has much wider occurrence and generally it is this sand that is often rereferred as the N_1 sand. The N_{1u} and N_{1L} correlate with the Verde-D and Verde-E respectively. The N_2, O_1 and O_2 are generally easy to carry cross country because each is separated by good regional shales. A lignite is often observed near the top of the N_2. Any other lignites associated with the O_1 and O_2 have limited areal extent. The N_2 correlates with the Verde-F_1, F_2 and uppermost F_3; the O_1 includes the Verde-G and H; and the O_2, with its two characteristic thin peaks, is the Verde-I and J. The base of the O_2 is the base of the Verde and the top of the Amarillo Members. The P_1, P_2 and P_3 are closely associated sands over most of the Greater Oficina fields. Their separation is a thin shale or one or more lignites often present near the top or at the base of the P_2. These sands may merge with one another. Regionally the P_1 and P_3 are more likely to shale out than the P_2, however, they will all retain their respective average interval thickness. These sands correlate with the Amarillo-A, B, C and D sands of the Anaco system.

Figure 4 shows the relation of the Oficina and Anaco nomenclatures for the sands and shales of the lower Oficina formation. The R_o and R_1 sands are separated by regional shales and are easily correlatable. Lignites may also help and are often noted in any portion of these sands but they are mostly of local occurrence. The R_o and R_1 correlate with the Amarillo-E and Amarillo F-G respectively. The R_2 is generally a fairly thick interval separated at the top and bottom by regional shales. Lignites may often appear near the top of this sand. The R_2 correlates with the section comprising the Amarillo-H through the Colorado-A_2. Near the base of the R_2 in downdip areas is a thin sand or silt zone; the top of this unit is the base of the Amarillo and the top of the Colorado Members. The R_3 is generally a thin sand over most of the Greater Oficina area and shales out widely. A lignite is often present near its base. The R_3 correlates with the Colorado-B and C sands. Below the R_3 is a regional shale. The R_{4u} and R_{4L} are easily separated in all downdip areas but to the south some difficulty may be experienced. The R_{4u} often shales out, or in places may merge with the R_{4L}. Lignites in this part of the section are generally of limited areal extent but are highly useful when present. The R_{4u} and R_{4L} correlate with the Colorado-D, E and F sands. Below the R_{4L} is a regional shale. The S_1, correlatable with the Colorado-G, is generally a variable interval whose correlation is frequently aided by a persistent lignite located near its base. The S_2 is more apt to retain its sandy character than the S_1. The S_2 correlates with the Colorado-H and I. The shale observed between the S_2 and S_3 may be considered regional. The S_3 and S_4 are closely related and some difficulty may be experienced in their correlation particularly in updip areas. They are separated mostly by interval thickness. The S_3 correlates with the Colorado-K and L sands while the S_4 is represented by the Colorado-M_1. The S_5 is the most difficult of the S sands to carry cross country. The principal reason is that it shales out over very wide areas and generally lacks distinctive characteristics. The S_5 is carried regionally on interval thickness. The T sand is one of the most widespread and most easily recognized unit top of the basal

Oficina section. It rests on a thick shale observable everywhere. This shale carries a fossil horizon designated by the Mene Grande laboratory as the Textularia-18 zonule. The T sand correlates with the Colorado-N_1, N_2 and perhaps the uppermost P_1. The U_1 sand, sandwiched between two regional shales, is also easily correlatable. It checks very well with the Colorado-R_1 and R_2. Usually the first massive sand located below the U_1 marks the base of the Oficina formation and the top of the Merecure.

Before I close, I wish to emphasize that the physical characteristics of the 93 Oficina sand units indicated by the four electric logs on Figures 2, 3 and 4 cannot be taken as typical development of any one sand or any one part of the section. The Oficina formation is characterized by ever-changing sand features that do not attain what may be called a typical section at any one place.

GENERAL DISCUSSION

HA: You say that you traced each of these sands in all directions, are they blanket sands?

JDS: I'm glad you asked me that question because it is a fundamental one. Several years ago when I re-examined the sand breakdown of the Oficina formation and its correlation throughout the Greater Oficina fields, I made several regional north-south and east-west trending cross sections for the purpose of determining which intervals of this formation were of regional character and how detailed a sand breakdown could be made and still be manageable over the whole area. In this I found the thick shale intervals and the numerous lignites associated with the sands to be of greatest aid. The complete formation was eventually divided into 93 sand units. Later an isopach maps was made of each sand. These maps clearly showed that all sands shale out somewhere within the area of study. The shale-out lines as well as the trend of maximum thickness of any given sand will generally have a north-south or an approximately north-south orientation. Some sands show distinct channel-like occurrence with fingers of sand shaling out laterally; others have a thin background sand upon which are superimposed thickened sand areas that are oriented in the same direction, and bear similar characteristics to the channel sands. Sands falling in this second group can be classified as blanket sands. Most sands of the Oficina formation are in this second category.

Anon: Is it actually possibly to carry this correlation cross country?

JDS: Well, you could carry a sand-by-sand correlation only if adequate control is available. You cannot correlate, for instance, a log from an updip area where the sand section is generally constricted (such as along the southern part of the Greater Oficina area) with another log showing an expanded section (such as La Ceibita or Zumo areas). However, if sufficient intervening control is available, it can be done.

Anon: Have you taken this correlation as far east as the Oritú area?

JDS: No, I haven't. But it probably could be done if enough logs are available.

Anon: Does any appreciable portion of the Oficina formation tend to shale out and if so, where?

JDS: Generally the Oficina sands are best developed along a north-south trending belt comprising perhaps the middle two-thirds of the Greater Oficina fields. To the west, the section gets poorer and to the east, the formation begins to shale out from the top. In the northeastern part, some wells show the upper Oficina formation completely shaled out down to the E_{2-3} sand.

Anon: Can the Oficina formation be recognized in the Jusepin trend?

JDS: On what basis, paleontologically?

Anon: No, I'm thinking about lithology.

JDS: No, you cannot recognize Oficina lithology there.

Anon: Have you correlated the Oficina formation in the area north of Santa Rosa?

JDS: Yes, the lower part can be traced into the La Ceiba area; the upper part of the formation is eroded off.

HA: The sands present in these northern areas currently carry different names but are actually the same as those of the lower part of the Oficina formation?

JDS: Exactly, the situation is analogous to Santa Ana Field where a totally different sand nomenclature was originally devised for a section later proven correlatable with any expanded downdip Oficina section.

Anon: The sands were named in reference to shale breaks. You can't trace any one of them over the whole area, can you?

JDS: Next to the thick shale beds as shown by this cross section, the lignites are probably the most useful in helping to tie down a given sand. Yes, I can trace any one of these sands anywhere within the area studied. Only on that basis, we were able to make an isopach map for each of the 93 sands comprising the Oficina formation.

Anon: But, they're not blanket sands; they come in and out.

JDS: All sands shale out somewhere on this map. Generally there is something within or near the shaled out zone to aid in correctly identifying a given sand when it reappears. Ordinarily such aids are lignites or silt streaks.

Anon: Isn't it a coincidence that your paleontological markers always come in at definite shale breaks?

JDS: Our Stratigraphic Laboratory can trace five paleontological zones as indicated by this cross section. As a general rule, these markers do not make their appearance exactly in the shale breaks indicated but very close to them. The range is ordinarily less than 100 feet but may be more in the northern areas.

Anon: Will the major shale breaks that you indicate always be shale breaks?

JDS: Yes, sir; they will always be shale. The only thing that may vary is the thickness. They are thin in updip areas and expanded in downdip regions.

Anon: Isn't it strange to have the sands and shale-out lines oriented north-south?

JDS: It is unusual, particularly when one takes into consideration that the embayment came from the east and that most of this area must have occupied a shelf area along the southern part of this embayment. If you consider any of the present day coast lines, you will generally find sand bodies oriented parallel with the coast and not at right angle with it. So, over most of this area, we must have had a completely different mechanism of sedimentation. The area was probably topographically very low, traversed by an intricate north-flowing drainage, having numerous interconnected bodies of water and with abundant vegetation to explain the many lignites. Also,

the preservation of thin underclays, root material and thin widespread lignites suggest that this area was protected from strong ocean currents or other destructive erosive processes.

Anon: Can you carry this correlation to Guárico?

JDS: No.

Anon: How far west can you carry it?

JDS: To the west of Toco through such wells as Chaparro, Apamate, Roblote and Las Ollas.

Anon: How far to the east?

JDS: I've taken it into the Junta area. The major reason why I haven't carried it farther east is that my isopach maps stop just west of this area.

Anon: How far updip can you carry it?

JDS: You mean how far to the south? Well, as far as we have well control.

Anon: All the 93 sands?

JDS: Yes, sir. The only thing that happens is that to the south, these nice shale breaks thin very much or may even disappear making the correlation more difficult. For that reason, one needs very close control along all updip areas. It might be of interest to point out that although some of the fields in the southern Greater Oficina area are quite old, it has only been within the past two or three years that a fairly reliable detailed correlation has been established.

KFD: You can carry some of the shale horizons into the Canoa wells 1 and 2.

JDS: I haven't done it.

Anon: Do these regional paleontological zones carry basinward to your major shale-out areas?

JDS: I understand that they do, at least within the area of control.

HA: Do you find any suggestion of an areal outline of a delta in any of these sands?

JDS: No, sir. I have never noted any pronounced indication of a deltaic configuration in any of the sands.

HA: All sands trend more or less north-south?

JDS: Yes, sir; as far as I have been able to trace them regionally. The main sand bodies will generally always trend approximately north-south.

Anon: What is the average width of a channel sand?

JDS: They vary. Some occupy perhaps three or four locations wide; others may be thinner or wider.

Anon: Is the erratic sand distribution itself somewhat indicative of a delta?

JDS: I don't like the word "erratic". There is nothing erratic to this thing. Generally, if enough well data are available, one can always note a certain arrangement or pattern. And that is one of the nicest things about working in this area, there is adequate control.

HA: Did you find any concentration of these various channel sands?

JDS: Yes, sir; channel sands may occur anywhere within the area studied but their greatest concentration is along the middle half or two-thirds of the Greater Oficina fields. One of their typical characteristis is that generally no two nearby channel sands are likely to be superimposed. There is always some shifting. Because of this stratigraphic compensation, the overall thickness of the formation remains about the same along its strike regardless of how many sands have thickened or thinned.

KFD: I think we have to be careful about this word "channel." The meaning with which we have to do here, I think, is the area in which your sand happens to show the biggest development. But it always shales out to the east and west. There are no channels in the true sense of the word. They all grade out.

JDS: Exactly. For that reason I doubt very much whether turbidity currents were ever operative in any part of this area. I have never been able to find any evidence of scouring in any portion of the Oficina formation in any of the Greater Oficina fields or Greater Anaco fields. All available evidence show that sedimentation during Oficina time was generally orderly and the main environmental factors were conclusive to preservation and not destruction of the sediments.

HA: How do you suppose those sands were formed? What is your idea about that?

JDS: Well, I visualize this area about the same as much of the Orinoco delta today. It must have been very low, with lots of vegetation, many interconnecting streams, lakes, swamps, close to the ocean and frequently covered up by it but not much affected by any of its destructive erosive processes, and with abundant sediments most of which were fine-grained. I cannot detect deltaic configurations in any specific sand but taking the formation as a whole, the available data seem to suggest that this area was just part of a large intricate drainage system flowing northwards from the Guayana shield.

HA: The rivers coming from the south were not big ones like the present day Orinoco?

JDS: That is probably right.

HA: Do you have any suggestion of how many fed in along one particular sand horizon?

JDS: Well, I've never tried to investigate that point. But I imagine only a few in the case of a predominatly channel sand and many in the case of blanket sands. You remember that the blanket sands typically have a thin background upon which are developed numerous thick north-trending sand bodies. The blanket sands generally have all the characteristics of coalescing channel sands.

KFD: How do you explain the big difference in the type of sequence of sediments that you have here and the wells that are actually drilled in the Orinoco Delta? In the upper part of the section in the Delta, there are no continuous beds whatsoever. You can't correlate from one well to the next. It's a completely different type of sedimentation. And yet you say that this was deposited in a similar environment.

JDS: I was just wondering if you are not confusing one thing here. You are talking about present-day sediments, aren't you?

KFD: Well, they were laid down in the same manner but in a different area. I'll name a specific area, the upper part of the Pedernales section above the Miocene.

JDS: Perhaps the situation was different there. The point is well taken. In attempting to reconstruct geological environments, one is often faced with the lack of complete or conclusive evidence. Data are by necessity deduced or interpreted, the result of which can never approach the factual data of most present-day geological phenomena. I have not seen the Pedernales section but from what you say, I would gather that the sedimentary environment was more influenced by sub-areal than sub-aqueous factors. During most of Oficina time, probably the overall environment in this area may have been deltaic but a type of delta more intimately related with the sea than land deposition. Undoubtedly, the sea covered the complete area repeatedly as indicated by the numerous blanket shales present throughout the Oficina formation. However, the fact that we find the apparently original sedimentary trends, numerous lignites throughout the section, leach underclays of different colors than typical Oficina shales, root material in cores, and the absence of scouring or erratic, haphazard deposition, suggests an environment of quiet deposition that was at, just above, or just below, seal level much of the time.

Mr. Gordon Young has suggested that at some future time we should have a further discussion on the deposition of the Oficina beds.

HA: Do I understand you to say that you can trace the Oficina lithology as far north as La Ceiba?

JDS: Yes, and farther north than that. The lower part of the formation is present; the upper is absent by erosion.

HA: What part of the Carapita section would that be?

JDS: Carapita?

HA: No, I had no ulterior motive at all. I was just wondering if the Oficina lithology reaches as far north as La Ceiba.

JDS: That's right, it does. The portion of the Oficina formation preserved contains sands and shales correlatable with the lower part of the formation. We do not find the typical Carapita lithology here. It is present farther to the east.

HA: How about those small zones that do carry through; are they present in the Carapita as such?

HHR: During the Oficina time, the environment of deposition was remarkably uniform from the Oficina area in the south to the Anaco area and farther north. For this reason, the foraminiferal zones can be carried over very long distances in the Eastern Venezuelan basin, and some of them can, in a broad sense, be recognized in the Carapita formation.

Anon: Are there any unconformities within the Oficina formation?

JDS: I have never been able to find any suggestion or any evidence of an unconformity within the Oficina formation.

HA: What about the Carapita?

JDS: You are talking about something of which we know relatively little about. I think the Carapita formation is one of the big question marks in Eastern Venezuela. It is a tremendously thick section about which there is a good deal more to be learned.

HA: Do you think there is an unconformity between the Oficina and the Merecure or the Periquito?

JDS: No, sir; although we cannot trace individual sands of the Merecure (or Periquito or the "U" sands) regionally, we can account for all units we arbitrarily may wish to make within a given field. Above the Merecure top, we find the standard Oficina sequence. I do not believe there is an unconformity at the top of the Merecure anywhere within the Greater Oficina Greater Anaco fields.

ML: When you say that you carry 93 different sands, do you mean that the sands carry laterally over the basin or that you can account for the sands in interval thickness within the shales?

JDS: We can account for the continued thickness of the sedimentary section even though locally the sands may have changed to silts or shales.

Participants:

HA - H. Alberding (Signal)
KFD - K.F. Dallmus (Dallmus & Thoms)
ML - M. Lesser (Continental)
Anon: The Editor regrets that the names of the majority of the participants were not recorded and that the voices were not sufficiently recognizable.

NUEVOS MIEMBROS

En la reunión del 17 de marzo de 1959, la Junta Directiva aceptó a las siguientes personas como miembros activos:

BLACK Jr., William T., Geology, Exploration Geologist, Martin, Sykes and Assoc., C.A., Caracas.

BLAKE, James K., Geology, Subsurface Geologist, Martin, Sykes and Assoc., C.A., Caracas.

DUCAS, James G., Geophysics, Seismologist, Martin, Sykes and Assoc., C.A., Caracas.

GARDNER, Don I., Geology, Subsurface Geologist, Phillips Petroleum Co., Maracaibo.

HEYDRICK, James Ch., Geology, Division Geologist for Eastern Venezuela, Phillips, Caracas.

HILLIER, Raymond L., Geology, Exploration Geologist, The Superior Oil Co. of Ven. Caracas.

KEIGHLEY, James R., Geology, Vice-President, Mining, Martin, Sykes and Assoc., C.A., Caracas.

KISER, Gerald D., Geology, Exploration Geologist, Martin, Sykes and Assoc., C.A., Caracas.

LINDSETH, Roy O., Executive, President, Tractores S.A., Caracas.

MARTIN, Bethea A., Geology, Associate, Martin, Sykes and Assoc., C.A., Caracas.

PADDOCK, Robert E., Geology, Exploration Geologist, Martin, Sykes and Assoc., C.A., Caracas.

ROSS, Steward H., Geology, Consultant, Ciudad Bolívar.

YOUNG, Theodore J., Geology, Subsurface Geologist, Socony Mobil Oil Co. de Ven., Anaco.

ZILBERBERG, Simon, Geology, Surface Geologist, Cía Shell de Venezuela Ltd., Caracas.