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Artikel: Contribution to the geology and paleontology of the area of the city La Habana, Cuba, and its Surroundings

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the younger sediments and with the serpentinites to the south are not known. It appears not to be in situ and may be either a slip mass within Vía Blanca beds or a tectonically dislocated mass, for which we did not introduce a new formational unit and name. Similar lithologies with *Nannoconus steinmanni* KAMPTNER were seen by us also in the uplift west of Habana, on the old road from Guanajay to Mariel, where they are likewise associated with Upper Cretaceous limestones and with serpentinites. Another occurrence of reworked Neocomian limestones close to the Habana area is represented by large subangular limestone blocks and pebbles with *Nannoconus steinmanni* KAMPTNER and Neocomian calpionellas in an arkosic conglomerate outcropping in a road cut of the Vía Blanca, 1.9 km northeast of the bridge over the Canasí river in northwestern Matanzas Province. Allochthonous specimens of *Nannoconus* were encountered in younger calcilutaceous sediments suggesting that Neocomian limestones were outcropping elsewhere in or close to the Habana area during the Upper Cretaceous.

The Neocomian limestones must have been deposited before the serpentinites were covered by the Cenomanian (?) to Turonian shales, radiolarites, silicified limestones and graywackes of the pre-Vía Blanca beds. The section described from the north flank of the Regla-Bacuranao uplift may be incomplete, and assuming that the ultramafics form the local basement, Neocomian limestones and perhaps older, possibly Jurassic beds, may still be found resting in structurally low areas on the serpentinites and overlain by the pre-Vía Blanca beds. The stratigraphic and structural problems posed by this singular exposure of Neocomian limestones cannot be solved in the Habana area.

Apart from the dark colored and thin-bedded Cenomanian (?) to Turonian shales of the pre-Vía Blanca series, and perhaps some shales of the Vía Blanca Formation, the Neocomian limestones are believed to be the only petroleum source rocks of the Habana area. The Neocomian limestones are dark-colored, fine-grained sediments of basinal environment to a large extent formed by the remains of planktonic organisms, and provided that reducing conditions prevailed during their deposition they may have generated hydrocarbons. These limestones or paleoecologically similar sediments of Cretaceous and Upper Jurassic age, such as the ammonite-bearing Oxfordian Jagua formation of Pinar del Río Province, are assumed to be the source of the petroleum produced today from the fracture systems of the serpentinite uplifts of northern Cuba, and seeping from the fractures of the Peñalver clastics and of spilitic flow rocks. They are probably also the source for the past submarine seepages which formed the accumulation of asphalt pebbles and the fracture fillings in the Universidad beds and in some of the younger beds (reworking from the Universidad formation ?) of the Marianao group of formations.

Pre-Vía Blanca Beds

Under the rather general term pre-Vía Blanca beds are here included the strata resting apparently unconformably on the serpentinites and which are overlain unconformably by the Vía Blanca formation. The pre-Vía Blanca beds are an heterogeneous group of lithologies consisting of indurated, in part siliceous shales, silicified limestones, radiolarites, opal, graywackes, tuffaceous beds, flow rocks and calcareous beds with serpentinite and other igneous fragments. Additional stratigraphic work needs to be done before one or more formation name(s) can be proposed for this series of lithologies. Fossil evidence suggests that they are, at least in part, of Turonian age. The pre-Vía Blanca graywackes and shales are thin-bedded and alternating and very similar lithologically to those of the younger Vía Blanca formation, so that it is usually not possible to distinguish shales and graywackes of the two units in the field. Moreover, in the Habana area the pre-Vía Blanca beds appear to be a thin unit, generally less than 20 m thick. For these reasons they are not differentiated in the interpretive geological map (plate II) and included in the Vía Blanca formation.

Pre-Vía Blanca beds are poorly exposed along the northern and southern flanks of the Regla-Guanabacoa serpentinite mass. Just east of the plant of the Concretera Nacional, coordinates 366.80 N and 365.34 E, pre-Vía Blanca beds are overlain, apparently unconformably by the Campanian Bahía conglomerate of the basal Vía Blanca formation. At this locality the pre-Vía Blanca graywackes and interbedded radiolarites show distinct slumping features. Silicified limestones occur and basal ophicalcites are well developed above the serpentinites. A questionable lithic tuff was noted. The faunas of the radiolarites and associated graywacke silts are diagnostic of Turonian, based on *Rotalipora* sp. affin to *Rotalipora turonica* (BROTZEN), *Praeglobotruncana* cf. *delrioensis* (PLUMMER) and 2-keeled *Globotruncana* spp. affin to *Globotruncana coronata* BOLLI. These forms were encountered in the stations described below.

BR station 866 and Sisson stations 319 and 320
Lithologies: Shale, silicified, laminated, fractured, medium light gray with olive green crusts. Interbedded with fine-grained graywacke sandstones.
Textures: Siliceous groundmass with abundant well-preserved Radiolaria. Microlamination through rhythmic accumulation of angular igneous grains. Common yellowish to dark brown minute inclusions suggesting organic material (kerogen ?).

Sisson stations 319 and 320, of mainly fine-grained graywacke texture, with radiolaria and planktonic Foraminifera.

Assemblage: Radiolaria
Sponge spicules
Meyenella meyeni DAVIS (as described by RIEDEL, 1953, p. 806, fig. 1)
Globotruncana sp. (2-keeled form affin to *Globotruncana coronata* BOLLI)
Praeglobotruncana cf. *delrioensis* (PLUMMER)
Rotalipora sp. (small form affin to *Rotalipora turonica* BROTZEN)
"*Globigerina*" cf. *subdigitata* CARMAN
Heterohelix sp. (finely striate form).

A better exposed outcrop of pre-Vía Blanca beds occurs in Reparto Muralla, west of the Vía Blanca highway, about 1.4 km northwest of the church of Guanabacoa. The coordinates of the outcrop are 367. 06 N and 364.92 E. At this point, massive highly slickensided and stressed serpentinites with rounded serpentinite "boulders" of up to 1 m diameter at the top of the serpentinite body, are overlain by about 6 m of ophicalcite, a barren, grayish yellow, friable calcareous material with abundant small angular serpentinite elements and larger elongate and rounded serpentinite stringers and inclusions. Sisson station 339 is from this outcrop. Associated with the serpentinite elements are tectonically stressed and fractured conglomeratic blocks of volcanic origin. The fractures of these blocks are filled with the above mentioned grayish yellow calcareous material. Stringers of calcitic material also penetrate into the main serpentinite body. The serpentinite elements are smaller and less common toward the top of the ophicalcite section, which is overlain apparently in normal sedimentary contact by about 1 m of cherty limestones. It is not known whether the ophicalcites represent a zone of weathering of the serpentinites or whether they were formed along a primary serpentinite-limestone contact. In the lower part, the cherty limestones are thin-bedded, broken-up and of rubbly appearance. There also occur interbedded calcareous layers with serpentinite elements. The cherty limestones are more massive in the upper part. The textures of thin sections show clearly that they were originally limestones, which later became fractured and silicified through silica-rich solutions. The cherty beds are followed by thin-bedded indurated and somewhat siliceous shales, graywacke siltstones and radiolarites. The top of these beds is not exposed at the Muralla outcrop. The siliceous shales and radiolarites from Sisson station 343, and BR stations 1355 and 1356 are rich in Radiolaria and *Meyenella meyeni* DAVIS. The latter exhibit a great variation in length and breadth of arms and in the development of the club-shaped tips. No *Nannoconus*, tintinnids or Foraminifera were found. The lack of diagnostic microfossils is disappointing because the outcrop clearly shows the sequence of beds, which rarely are as well exposed as at this locality. Similar Radiolaria and *Meyenella meyeni* DAVIS assemblages were also encountered in the first mentioned outcrop east of the plant of the Concretera Nacional and are suggestive of age equivalence of the two radiolarite occurrences.

GLAESSNER (1952, pp. 83, 84) discussed the genetic problem of the radiolarite zones of the folded belts of the Port Moresby Group, Papua. The depth of deposition is apparently unrelated to the silica enrichment, and there is no evidence that the bulk of the bedded chert of the Port Moresby Group is derived from the siliceous tests of Radiolaria or other siliceous organisms. GLAESSNER agrees with DAVIS (1918), who studied the Franciscan radiolarites of California in great detail, that the cherts were produced from solutions coming from pillow lavas and from submarine siliceous springs associated with that particular type of volcanic activity. This interpretation is here accepted to explain the silica-rich beds of the pre-Vía Blanca series. In the Habana area, the chert beds are not known to be accompanied by pillow lavas, but spilitic flows and tuffaceous rocks were observed elsewhere with radiolarites as in Mina Margot, west of Matanzas, and in the area of Bahía Honda, west of Habana (personal communication J. P. BAUGHMAN). A variolitic pillow lava occurs on the continuation of the Avenida Monumental about 5.9 km north of its intersection with the Carretera Central. The field relationship of these volcanic beds is not known, but they most probably form part of the pre-Via Blanca beds. One of the authors (D.R., 1961) has emphasized the significance of Upper Cretaceous siliceous solutions in the serpentinization of the Cuban ultramafics as well as in the formation of opal and the silicification of certain sediments.

The following stations described below are from bottom to top of the road cut in Reparto Muralla:

Sisson station 339
Lithology: Calcareous material, friable, grayish yellow, with angular to rounded fragments of serpentine and of conglomeratic igneous rocks. Barren.

BR station 1354 (Silicified limestone upper part)
Lithology: Limestone, siliceous, fractured, hard, medium light gray to pale yellowish brown.
Texture: Recrystallized calcite, interstices and fractures with dark brown substance, larger fractures filled with clear amorphous silica. Secondary silicification. Barren.

Sisson station 340 (Silicified limestone lower part)
Lithology: Limestone, grayish, and silica, brownish, irregularly interlaminated, vacuolar.
Texture: Recrystallized calcite, fractured, and laminated, with amorphous silica in layers and in fractures. Secondary silicification of limestone. Limestone and silica with dark brown substance, probably hydrocarbon, in interstices and along boundaries. Barren.

Sisson station 341 (Graywacke siltstone on top of silicified limestone)
Lithology: Siltstone, non-calcareous, pale yellowish to brown. Barren.

Sisson station 344 (Base of shale-radiolarite section on top of graywacke siltstone).
Lithology; Siltstone, non-calcareous, finely laminated, moderate yellowish brown. Barren.

Sisson stations 342 and 343 (Shale, siltstone and radiolarite)

(1) Lithology: Shale, non-calcareous, moderate to dark yellowish brown and shale, silty, calcareous, grayish yellow. Barren.
(2) Lithology: Radiolarite, bluish gray to medium gray.
Texture: Groundmass silicified, fractured and vacuolar, with dark brown substance, probably hydrocarbon, along fractures and in cavities and in form of globules. Abundant, in part well-preserved Radiolaria.
Assemblage: Radiolaria
Meyenella meyeni DAVIS (very variable forms).

BR station 1355 (Silicified shale)
Lithology: Shale, silicified, olive gray.
Texture: Siliceous groundmass, with recrystallized Radiolaria and with common mainly angular serpentine and other igneous fragments. Dark brown substance, probably hydrocarbon, in form of globules and specks.
Assemblage: Radiolaria.

BR station 1356 (Radiolarite interbedded in graywacke siltstones)
Lithology: Radiolarite, medium gray to medium bluish gray, with greenish yellowish crusts.
Texture: As Sisson station 343. Fractures filled with silica. Interbedded with layers showing fine-grained graywacke texture.

Assemblage: Radiolaria (abundant)
Meyenella meyeni DAVIS (abundant, with very variable shapes)

Another good outcrop of pre-Vía Blanca beds occurs north of Residencial Guanabacoa, coordinates 367.80 N and 370.68 E. The outcrop is about 1 km east of BR station 248, described later in this chapter. The geographic locations of the stations at this outcrop are explained in the index-map, text-fig. 2. The actual contact between the serpentinites and the adjoining sediments was not seen. Ophicalcites seem to be lacking. The pre-Vía Blanca beds, represented by Baughman stations 1482, 1483, 1764 and 1765, consist of thin-bedded siliceous shales, silty shales, radiolarites, and lenticular bodies of lithic tuffs embedded in the siliceous shales. The contact between these beds and the Vía Blanca formation of Baughman stations 1484 and 1486 is covered.

Baughman stations 1482 and 1765 (pre-Vía Blanca beds)
Lithologies: (1) Tuff, light yellowish gray, and
(2) Tuff, laminated, yellowish gray to gray, and
(3) Lithic tuff, greenish to pale yellow brown.
Texture: (1) Siliceous groundmass with abundant glass shards and Radiolaria. Globules of dark brown substance, possibly kerogen.
Assemblage: Radiolaria.
Texture: (2) Siliceous groundmass with abundant Radiolaria and some glass shards and angular igneous grains.
Assemblage: Radiolaria
Heterohelix sp. or *Pseudoguembelina* sp.
Texture: (3) H. H. HESS (letter, February 23, 1959) described this rock as a lithic tuff or possibly a flow breccia. It is composed of fragments largely of glass or decomposed glass with large fresh zoned plagioclases and fresh augites. The plagioclase is optically positive and has indices of refraction considerably higher than balsam so it probably is andesine or labradorite. There are a few pieces of fine-grained feldspar, with almost holocrystalline lava and some that are entirely glassy and vesiculated (pumice). This material is embedded in form of lenticular bodies in the siliceous Radiolaria-bearing beds described under (1) and (2). The sample from Baughman station 1765 is identical with this rock.
Assemblage: Radiolaria.

Baughman station 1483 (pre-Vía Blanca beds)
Lithology: Graywacke sandstone, shaley, non-calcareous, light brown to grayish orange. Barren.
Baughman station 1484 (Vía Blanca formation, Campanian)
Lithology: Graywacke sandstone, fine-grained, calcareous, grayish orange to pale yellowish brown.
Texture: Microcrystalline recrystallized calcite groundmass with rather densely packed angular igneous and limestone grains, fragments of mollusks, echinoderms and algae and some planktonic and benthonic Foraminifera. Diameter of average fragments ranges from about 50 to 250 μ.

Assemblage: *Globotruncana fornicata* PLUMMER
Pseudorbitoides sp. with single set of radial plates
Heterohelix cf. *pulchra* (BROTZEN)
Pithonella ovalis (KAUFMANN)
Calcisphaerula innominata BONET.

Baughman station 1485 (Vía Blanca formation, *Rugotruncana gansseri* zone)
Lithology: Graywacke sandstone, calcareous, pale yellowish brown.
Texture: As Baughman station 1484, but unsorted and coarser. Diameters of average components range from about 100 to 3000μ.

Assemblage: *Vaughanina cubensis* D. K. PALMER
Orbitoides palmeri GRAVELL
Sulcoperculina spp.
Orbitocyclina sp.
Asterorbis sp.
Cosinella sp.
Kathina jamaicensis (CUSHMAN and JARVIS)
Coskinolina sp.
Pithonella ovalis (KAUFMANN)
Calcisphaerula innominata BONET
Pseudotextularia elegans (RZEHAK)
Globotruncana stuarti (DE LAPPARENT)
Rugotruncana gansseri (BOLLI).

Vaughanina cubensis D. K. PALMER, 1934, is the morphologically most complex pseudorbitoid derived from *Sulcoperculina* THALMANN, 1938. Intermediate forms linking *Sulcoperculina* and *Vaughanina* have not been found. However, the early ontogenetic stages of *Vaughanina* clearly indicate a *Sulcoperculina* ancestor. *V. cubensis* always has been regarded as diagnostic of Maastrichtian (BRÖNNIMANN, 1952) and its frequent occurrence in Tertiary beds was generally believed to be allochthonous. However, we found *V. cubensis* in many old Tertiary samples to the exclusion of the usually associated reworked Upper Cretaceous benthonic Foraminifera such as *Omphalocyclus macroporus* LAMARCK, *Orbitoides palmeri* GRAVELL, *Asterorbis* spp. etc. suggesting an extension of the life range of the pseudorbitoid into the oldest Tertiary.

The ancestors of the bilaterally symmetric *Orbitoides* D'ORBIGNY, 1847, genotype *Orbitolites media* D'ARCHIAC, 1837, appear to be asymmetric *Acervulina*-like forms of great morphologic plasticity (BRÖNNIMANN, 1958, p. 175, 176). *Orbitoides* D'ORBIGNY is not related with *Pseudorbitoides* H. DOUVILLÉ nor with the group of *Orbitocyclina* VAUGHAN–*Lepidorbitoides* SILVESTRI. The latter forms may have evolved from *Pseudorbitoides* (BRÖNNIMANN, 1955).

Baughman station 1486
Lithology: Shale, non-calcareous, moderate yellowish brown. Washed residue with well-preserved Radiolaria.

One of the most impressive exposures of pre-Vía Blanca beds and underlying ultramafics is at the road cut on the continuation of the Avenida Monumental about 2 km southeast of the intersection with the Vía Blanca highway, south-

southeast of coordinates 367.40 N and 369.54 E. The contacts between the sediments and the serpentinized gabbro-peridotite uplift are well exposed, those between pre-Vía Blanca beds and Vía Blanca formation are covered. The pre-Vía Blanca beds consist of graywackes with interbedded bentonitic silty shales, radiolarites and grayish white and greenish yellow tuffs. Of particular interest is the occurrence in some beds of coarser graywackes of scattered quartz grains and of small fragments of serpentinite, the latter again suggesting stratigraphic contact with the serpentinites. As shown in the cross-sections, fig. 1, the structural conditions are extremely complicated and the contacts are tectonically squeezed and slickensided. Nowhere occurs contact metamorphism, an observation which agrees with those of L. RUTTEN (1940, p. 545) on the contacts between Guanabacoa serpentinite and Upper Cretaceous limestones, and of WASSALL (1956) on the contacts between serpentinites and volcanics in Las Villas Province. Also HILL (1958) described the contacts with the serpentinites of the Trinidad Mountains, serpentinized olivine gabbros of unknown age, to appear to be lacking indications of contact metamorphism. At the continuation of the Avenida Monumental, the pre-Vía Blanca beds are intricately associated with igneous rocks. Some of them carry an old Upper Cretaceous, Turonian or slightly older planktonic fauna with *"Globigerina" subdigitata* CARMAN, *"Globigerinella"* sp. and *"Globigerina"* sp. The stratigraphic positions of the below described stations are explained in the cross section, fig. 1.

BR station 248
Lithology: Shale, non-calcareous, moderate yellow brown.
Washed residue with

- *"Globigerina" subdigitata* CARMAN
- *"Globigerina"* sp. (5 to 6 chambers in the final whorl with finely spinose walls, and 5 to 8 chambered forms with smooth walls)
- *"Globigerinella"* sp. (practically identical with the form illustrated by CARMAN, 1929, p. 34, fig. 6)
- *Rotalipora* sp. or single-keeled *Globotruncana* sp. (casts)
- *Radiolaria* (large and well preserved specimens as described in BR stations 1047 to 1049).

BR station 1042
Lithology: Shale, calcareous, grayish orange.
Washed residue with

- *Globotruncana fornicata* PLUMMER
- *Globotruncana lapparenti* BROTZEN group
- *Globotruncana* cf. *linneiana* (D'ORBIGNY)
- *Globotruncana* cf. *marginata* (REUSS)
- *Globotruncana* cf. *sigali* REICHEL
- *"Globigerina"* sp. (5 to 6 chambered forms with finely spinose walls)
- *"Globigerinella"* cf. *escheri* (KAUFMANN)
- *Pseudoguembelina striata* (EHRENBERG)
- *Pseudoguembelina* cf. *excolata* (CUSHMAN)
- *Heterohelix globulosa* (EHRENBERG)
- Radiolaria.

BR station 1043

The assemblage is closely related to that from BR station 248.

Lithology: Limestone, hard, pale yellow brown.

Texture: Finely microcrystalline groundmass with planktonic microfossils and minute angular igneous grains.

Washed residue with

"*Globigerina*" cf. *subdigitata* CARMAN
"*Globigerina*" sp.
"*Globigerinella*" cf. *escheri* (KAUFMANN)
Heterohelix cf. *globulosa* (EHRENBERG).

BR station 1044

Lithology: Chalk, soft, very pale orange.

Washed residue with

Heterohelix cf. *globulosa* (EHRENBERG)
"*Globigerinella*" cf. *escheri* (KAUFMANN)
Radiolaria.

BR station 1045

Lithology: Limestone, hard, dense, pale greenish yellow (1), and graywacke sandstone, calcareous, pale brown (2).

(1) Texture: Cryptocrystalline argillaceous groundmass with planktonic microfossils.

Assemblage: "*Globigerinella*" *escheri clavata* BRÖNNIMANN
"*Globigerinella*" *escheri clavata* BRÖNNIMANN or "*Globigerina*" *subdigitata* CARMAN
"*Globigerina*" sp. (finely spinose, thin-walled and thick-walled forms)
Globotruncana sp.
Heterohelix cf. *globulosa* (EHRENBERG)
Schackoina sp. (complanate, aspect of chambers affin to *Schackoina cenomana* (SCHACKO))
Tubulospines of *Schackoina* sp.
Radiolaria
Coccoliths.

(2) Texture: Microcrystalline groundmass with densely packed angular to subangular fragments of brown and green igneous rocks and planktonic microfossils.

Assemblage: *Globotruncana* sp.

BR station 1046

Lithology: Tuff, pale greenish yellow.

Texture: Mainly glass shards and igneous grains arranged in layers.

Washed residue with Radiolaria and sponge spicules.

BR stations 1047, 1048 and 1049

The here listed samples are lithologically and faunally very similar and therefore described together.

Lithologies: Shale, non-calcareous, soft, grayish orange (1047), grayish yellow (1948), and silty, light brown (1049).
Washed residues with similar suites of large and well preserved Radiolaria.

BR station 1050
Lithology: Radiolarite, light olive gray.
Texture: Silicified groundmass with abundant Radiolaria. Alignment and shape of Radiolaria show stress.
Assemblage: *Meyenella meyeni* DAVIS
Radiolaria.

As in BR stations 866, 1356, and Sisson stations 319, 320 and 343 from the pre-Vía Blanca beds north of the Regla-Guanabacoa serpentinite body, the radiolarities contain abundant Radiolaria and *Meyenella meyeni* DAVIS.

Although in most instances no clear evidence for a stratigraphic contact of sediments on the serpentinites and associated rocks was found, we suggest that the contacts between the pre-Vía Blanca series and ultramafics were originally sedimentary contacts such as the one described from the road cut at Reparto Muralla, but that because of the later tectonic movements many of the contacts are now of distinctly tectonic aspect. SCHÜRMANN (1935, pp. 347–348) mentioned rolled fragments of serpentine in the transgressive Cretaceous of Habana. In respect to the contacts between sediments and larger serpentine bodies of Matanzas and Habana provinces, SCHÜRMANN noted that it is not always possible to prove that transgression of younger Cretaceous on an older erosional relic should be excluded and that the contacts are of tectonic nature.

DE VLETTER (1946, p. 24) considered the possibility that in Oriente Province "Habana formation" transgressed on the serpentinites. He noticed at the contacts frequently loose and partly rounded fragments of serpentine and gabbroidic rocks, which may belong to a basal conglomerate of the "Habana formation" suggesting a transgressive contact. The contacts however may be simply of tectonic nature, as also at clearly tectonic contacts occasionally loose gabbroidic blocks were observed. VAN RAADSHOVEN (in DE VLETTER, 1946, p. 25) found the serpentinites occasionally so intensely weathered that only blocks of serpentine and gabbro occurred without massive serpentinites suggesting weathering prior to transgressive contacts with the overlying sediments.

Quartz grains in some beds of the pre-Vía Blanca series indicate that quartz-bearing rocks, for instance granitic or gneissic rocks, were also exposed at the time of the pre-Vía Blanca transgression. The Cenomanian (?) to Turonian age of the pre-Vía Blanca beds corresponds closely with that of the "Tuff formation" and interbedded Provincial limestone of central Cuba, which on the basis of cephalopods and rudists is early Upper Cretaceous, probably Cenomanian to Coniacian (IMLAY, 1944, pp. 1011–1013). Lithologically the "Tuff formation" is clearly related with the pre-Vía Blanca beds. CHUBB (1956, pp. 10, 11) tentatively correlated the *Tepeyacia* rudist fauna of the Provincial limestone with *Caprinulinoides perfecta* PALMER, *Coalcomana ramosa* (BOEHM), *Sabinia* sp., *Ichthyosarcolites* sp., and *Tepeyacia corrugata* PALMER with the Cenomanian to Turonian *Inoceramus* series of Jamaica. The sedimentary gap between the pre-Vía Blanca beds and the

Vía Blanca formation can be explained either by non-deposition due to emersion, or by erosion due to submarine currents, or by lack of any sedimentation, or by erosion prior to the deposition of the Vía Blanca formation. The first possibility is regarded as improbable because no evidence for subaerial weathering of the pre-Vía Blanca beds was found, and the last explanation is likewise improbable because there are no components of post-Turonian to pre-Campanian age in the conglomerates of the Via Blanca formation. Non-deposition due to submarine currents is probably the correct explanation. It was previously noted that sediments of Emscherian age were found only at a few scattered outcrops and that the post-Turonian to pre-Campanian sedimentary gap is encountered almost throughout Cuba.

Vía Blanca Formation

Underlying the Peñalver formation and probably transgressive on pre-Campanian strata there is a series of Upper Cretaceous mainly clastic sediments, here called Vía Blanca formation, which shows striking lithologic similarities with the younger clastic formations of the Habana group. The name is derived from the Vía Blanca, the north coast highway connecting Habana with Varadero, which opens up good exposures of the formation along road cuts immediately east of the Bahía de la Habana. The Vía Blanca formation has a wide geographic distribution as it is also known in the area of Bahía Honda about 90 km west of Habana. The Vía Blanca beds are very strongly folded and cut by numerous minor faults and except for a few road cuts poorly exposed. There is no place in the Habana area where a continuous undisturbed section of over 50 m can be measured, and the here described isolated outcrops do not afford more than a tentative grouping of lithologies. The thickness of the formation is estimated at about 500 m. The Vía Blanca formation extends in age from the Campanian *Globotruncana linneiana* zone to the *Rugotruncana gansseri* zone of the Lower Maastrichtian.

The present notes are preliminary and restricted to the description and age evaluation of the different lithologic units here assigned to the Vía Blanca formation. Future work will show whether or not the Vía Blanca formation could be differentiated into two or more lithologic units of formation rank.

The discontinuity of the outcrops and the complicated structure of the beds do not allow the designation of a type section representing all the different lithologies here included in the Vía Blanca formation. For this reason we will describe several discrete outcrops, none of which alone would suffice to define the Vía Blanca formation. However, together they furnish a relatively good understanding of the Vía Blanca lithologies.

Outcrop pattern

The best exposures are along the Vía Blanca highway north and northeast of the town of Guanabacoa, and along the recently constructed road which is the continuation to the southeast of the Avenida Monumental, connecting the Vía Blanca highway and the Carretera Central near Cuatro Caminos. Other fair to good outcrops are in the areas east of Casa Blanca, and southeast of Habana between Santa María del Rosario, El Calvario and the Bahía de la Habana. West