# EARLY PLIOCENE *MONTFORTELLA* (FORAMINIFERIDA) FROM ECUADOR

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*This article is dedicated to*
*R. W. Crouch*
*(1921 - 1984)*

## ABSTRACT

The genus *Montfortella* Loeblich and Tappan, 1963, is documented from Quebrada Camarones, Ecuador, in sediments of Early Pliocene age. This record represents the oldest known occurrence of this genus to date and also the first known occurrence in Ecuador. Observations are made on morphologic modifications of the intercameral openings, and the suggestion is made that these modifications permit improved seawater circulation from one surface of the test to the other, plus possibly enhance osmotic interaction between the foraminiferan and the seawater.

The oldest previously documented stratigraphic occurrence of the genus *Montfortella* Loeblich and Tappan, 1963, is from Early Pliocene (planktic zone N19) sediments exposed on the Isthmus of Tehuantepec, Mexico (Kohl, 1985). The genus ranges from the Early Pliocene to the Modern (Loeblich and Tappan, 1963; McCulloch, 1977; Kohl and Haman, 1980). The purpose of this article is to document for the first time the presence of this genus in the Pliocene of Ecuador. This record also represents the oldest stratigraphic occurrence for the genus.

In October 1980, the senior author was sent specimens of *Montfortella* by the late R. W. Crouch. The locality data provided was "Esmeraldas fm. Quebrada Camarones, Ecuador. On cliff above A. A. Olsson loc." Olsson (1942, p. 260) states "The name Esmeraldas formation may be given to the highly foraminiferal tuffaceous shales so extensively exposed along the coast of Esmeraldas and along the Esmeraldas river itself." This casual reference by Olsson (1942) has been criticized by Bristow (1976, p. 193) who stated, "The Esmeraldas Formation...was never properly defined by Olsson. From his descriptions it is evident that it includes most outcrops of the Onzole Formation, but locally (Quebrada Camarones) the Angostura Formation, and probably in the Esmeraldas area, some or all of the Borbón Formation." Cushman and Stainforth (1951) regarded the Rio Camarones (=Quebrada Camarones) beds as late Middle to early Upper Miocene and referred to them as part of the Borbón Formation. Hoffstetter (1956), in his review of the coastal stratigraphy of Ecuador, also did not accept the Esmeraldas Formation as described by Olsson.

As can be seen, the rock stratigraphic nomenclature at Quebrada Camarones is confused. The stratigraphy of this area is under detailed evaluation by E. H. Vokes (in press). She recognizes the Esmeraldas Formation and defines the type locality as "Quebrada Camarones, cut-bank on east side of canyon, which is at east edge of village of Camarones, 20 km. (by road) east of bridge over Rio Esmeraldas, at Esmeraldas, *or* approximately 5 km. east of mouth of Rio Esmeraldas, Prov. of Esmeraldas, Ecuador." This locality has been designated as Tulane locality TU 1397. The Crouch sample was collected by Mr. W. D. Pitt and termed sample B. Mr. Pitt (pers. comm. Jan. 1985) stated "When Olsson collected the cliff, he collected float material from the base of the cliff as it is too steep to collect the different strata on the face. In looking at the cliff, locality B was at the left hand side and was from a large block that had fallen from near the top of the cliff."

It is clear from microfaunal analysis that the Crouch-Pitt sample and the TU 1397 sample are coeval. The TU 1397 sample has been dated (Kohl *in* Vokes, in press) as planktic zone N18/19 and we have dated

the Crouch-Pitt sample as the same age. Locality maps provided for this exposure by Mr. Pitt and Professor Vokes demonstrate that their respective localities are in fact the same.

Two specimens of *Montfortella* were obtained from the Quebrada Camarones sample. One (Pl. 1, Figs. 1-4) has well defined sutural openings while in the other (Pl. 1, Figs. 5-6) the sutural openings are infilled and resisted cleaning efforts. The possible life mode of *Montfortella* and the role of the sutural openings have been discussed in Kohl and Haman (1980). The Ecuadorian specimens do permit us to make further observations on the sutural openings. It has been noted (Loeblich and Tappan, 1963; McCulloch, 1977; and Kohl and Haman, 1980) that the intercameral sutural openings are slit-like in character. The opening displayed by one of our specimens along the suture between the penultimate and broken presumably ultimate chamber indicates a flute-like modification to the basic slit (see Pl. 1, Fig. 4). This modification is located at the penultimate chamber margin side of the opening. Similar fluting can also be seen on the ultimate chamber margin side of the opening (Pl. 1, Fig. 2). The functional morphology of this fluting is open to question. McCulloch (1977) has suggested that these slits allow seawater to circulate to the attached side of the test. If this suggestion is accepted, it may be further postulated that the fluting of the slits increases the surface area within the slits which could, in turn enhance any osmotic exchange between the seawater and the foraminiferan.

We retain our Ecuadorian specimens in the species *Montfortella bramlettei* Loeblich and Tappan, 1963.

As stated, two specimens of *Montfortella* were obtained in this study. This may be regarded as a very rare occurrence especially as other sessile forms such as *Cibicides* are fairly common. The associated benthic foraminiferal assemblage is rich and diverse, composed of *Allomorphina, Amphistegina, Bolivina, Brizalina, Bulimina, Cassidulina, Discorbis, Elphidium, Gaudryina, Gyroidina, Hanzawaia, Lagena, Lenticulina, Martinottiella, Nodosaria, Pullenia, Quinqueloculina, Reussella, Saracenaria, Trifarina, Uvigerina, Vaginulina,* etc. This association suggests a mixture of two distinct foraminiferal assemblages which represent two different paleoenvironments. This interpretation agrees well with the concept of Vokes (in press), based on molluscan assemblages, that the Esmeraldas Formation represents a deep water environment with interspersed shallow water gravity flow lenses. We regard the deep-water microfaunal elements as representing an outer shelf/upper slope paleobathymetry while the shallow water benthic components represent an inner to middle shelf environment.

The planktic component is diverse with in excess of ten species of planktic foraminifera and in excess of four diagnostic species of calcareous nannoplankton. The planktic components allow us to date the subject sample as zone N18/19 (earliest Pliocene); which verfies the Kohl *in* Vokes (in press) determination.

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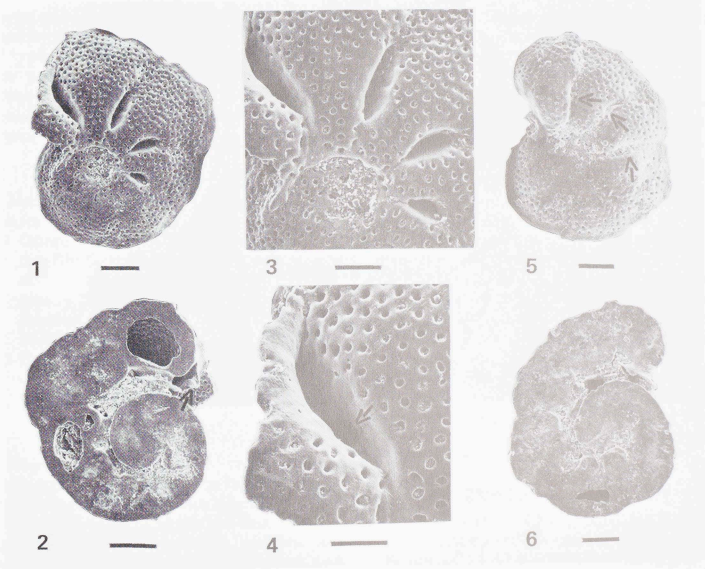


PLATE 1

*Montfortella bramlettei* Loeblich & Tappan

Bar = 50 μm (figs. 1, 2, 5, 6), = 25 μm (figs. 3, 4).

Figures

1, 2. Umbilical and spiral views. Arrow on fig. 2 indicates fluting of intercameral opening.

3. Detail of intercameral sutural openings.

4. Detail of opening along intercameral suture between penultimate and ultimate chamber. Arrow indicates area of fluting.

5, 6. Umbilical and spiral views. Arrows on fig. 5 indicate infilled intercameral openings.