The Guayape-Papalutla fault system: A continuous Cretaceous structure from southern Mexico to the Chortís block? Tectonic implications: COMMENT and REPLY

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The use of piercing points in making paleogeographic reconstructions greatly adds to their accuracy beyond that available using other techniques. Thus, Silva-Romo’s (2008) proposal that the Papalutla fault in southern Mexico and the Guayape fault in Honduras provide piercing points to constrain a Late Cretaceous reconstruction (Fig. 1) of the allochthonous Chortís block is a worthwhile objective. However, such a correlation raises more questions than it solves.

QUESTIONS
1. What Euler pole was used? Silva-Romo (2008, p. 75) states that it is a “nonrotational hypothesis” and that the Chortís block was merely moved westwards. This implies that the Euler pole lay 90° away to the south, near the coast of Antarctica. This contradicts the Cenozoic Euler pole for the Caribbean plate derived by both Pindell et al. (1988) and Ross and Sc十月se (1988), which lies near Santiago (Chile), i.e. ~50° to the SSE of the Cayman Trough. This Euler pole is consistent with the southward concavity of the Cayman Trough transform faults.
2. How is the Chortís block transported through the Gulf of Tehuantepec, which contains an undeformed Late Cretaceous–Holocene sedimentary sequence that straddles the Motagua fault zone, generally considered to be the boundary between the Chortís and Maya blocks (Keppie and Morán-Zenteno, 2005)?
3. Where is the Nicaragua Rise in the Late Cretaceous reconstruction? It is generally considered to be part of the Chortís block (Rogers et al., 2007, and references therein), which poses a geometric problem because it would overlap southern Mexico in Silva-Romo’s (2008) reconstruction.
4. Why does Silva-Romo use a WNW-trending boundary for the northern margin of the Chortís block, when no such feature has been identified? The northern boundary of the Chortís block, which presently lies on the Caribbean plate, is generally located along the ENE-trending Cayman transform faults (Leroy et al., 2000). The latter boundary lies ~20° clockwise of the Guayape Fault, which, if projected northeastswards, would intersect the Cayman Trough at 80°W, not 85°W as shown by Silva-Romo.

PROBLEMATIC STATEMENTS
Silva-Romo makes the following problematic statements:
1. “The Papalutla fault represents the eastern limit of the Guerrero-Morelos Platform” (p. 76), which is characterized by Cretaceous shelf carbonates (Centeno-García et al., 2008). Such carbonates represent an overstep sequence that extends from the eastern boundary of the Guerrero terrane (located west of the Papalutla fault) across the Mixteca, Oaxaquia, and Maya terranes (Keppie, 2004). This suggests that the Papalutla fault lies within the Paleozoic Mixteca terrane (comprising the Acatlán Complex) (Centeno-García et al., 2008).
2. “Basement rocks of the Central Chortís terrane are similar to those of the Acatlán Complex” (p. 76). This contradicts Rogers et al. (2007) who state that the Central Chortís terrane represents the core of the Chortís superterrace (including the Northern, Central and Eastern Chortís terranes), which is underlain by ~1 Ga basement.
3. “Northeast of Papalutla town, the Papalutla fault displays left lateral strike slip” (p. 76). At this location, the Papalutla fault deviates from its general NE trend into an E-W trend. This may explain the discrepancy between the kinematics: thrust (Cerca et al., 2007) or sinistral strike-slip (Silva-Romo, 2008).

FUTURE RECONSTRUCTIONS
Any future reconstructions must take into account the following:
1. The Euler pole and displacement across the Cayman Trough since 49 Ma (Leroy et al., 2000).
2. The undeformed, untruncated nature of the latest Cretaceous sediments in the Gulf of Tehuantepec that straddle the Motagua Fault Zone (Keppie and Morán-Zenteno, 2005).
3. Removal of an ~210-km-wide Eocene-Oligocene forearc from the southern coast of Mexico during the Upper Oligocene and Lower Miocene (Keppie et al., 2007).

Figure 1. Late Cretaceous reconstruction of southern Mexico and the location of the Chortís block and the Guayape fault according to Silva-Romo (2008), in contrast to that of Rogers et al. (2007). GF—Guayape Fault; PF—Papalutla Fault.

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Cretaceous structure from southern Mexico to the Chortís block? Tectonic
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In Figure 1 of his Comment (Keppie, 2008), Keppie confused the
Papalutla fault with the Teloloapan fault in his Comment’s Figure. Here
(in my Figure 1), I correctly identify the Papalutla fault in south Mexico,
which supports my original hypothesis (Silva-Romo, 2008).
ANSWERS
Keppie presented a list of questions, which I answer here.
1. My hypothesis assumes a Caribbean plate stationary relative to the
mantle after Chron 18 at 38.4 Ma (Müller et al., 1999).
2. The ancestral Acapulco trench–Motagua transform fault was dis-
located ~70 km by the Chiapa massif southeast displacement, during
Neogene convergence of the North America and South America
plates after the Chortís block departure (Silva-Romo and Mendoza-
Rosales, 2007). Thereafter, the sedimentary sequence of the Gulf of
Tehuantepec was northward from the fault zone.
3. The structural characteristics of the Colon fold belt of Honduras
(Rogers et al., 2007a) are congruent with a left strike-slip fault system,
which might have displaced the Nicaraguan Rise from a south-
west location during Cenozoic time.
CLARIFYING STATEMENTS
In response to Keppie’s “Problematical Statements” (1) and (3): Just as
the tectonostratigraphic division does, the Papalutla fault may cut the
Mixteca terrane (Campa and Coney, 1983; Keppie, 2004) or be a terrace
boundary (Sedlock et al., 1993). When comparing my model with the cor-
relation between southern Mexico and the Chortís block (Rogers et al.,
2007a), I used the tectonostratigraphic map of Campa and Coney (1983).
Here, I claim that Papalutla fault (1) is a major structure that controlled
Cretaceous sedimentation in the Guerrero-Morelos platform, which has
a different Cretaceous stratigraphic column than the Mixteca terrane
(Hernández-Romano, 1999); (2) its main Laramide kinematics were left-
slip; (3) its inverse thrust segment near Papalutla town is a right bend in
a left-slip fault; (4) its northeast projection is hidden by the eastern sector
of the Transmexican volcanic belt (Fig. 1A)—on this sector, the Papalutla
fault acted as tear fault in an Eocene Laramide thrust belt, as Mossman
and Viney (1976) expected; and (5) the Papalutla fault projection was
reactivated as a normal fault, and the tectonic front became the Cenozoic
complex Veracruz Basin (Jannette et al., 2003).
In response to Statement 2: Laramide reconstruction by Keppie
(2004) invokes a Oaxaca terrane dislocated by a major left-slip fault
where the Transmexican volcanic belt is presently located (Fig. 1B).
I propose the Papalutla fault is that major structure (Fig. 1A). With this
tectonic array, an ~1 G basement may extend below Guerrero-Morelos
platform and may conciliate with central Chortís terrane basement in-
voked in Keppie’s Comment.
FUTURE RECONSTRUCTIONS
My model allows some rotation of the Chortís block and erosion by
subduction after the Chortís block departure, but southern Mexico trunca-
tion only by erosion by subduction (Keppie et al., 2007) implies a rate
process yet unproven.
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Figure 1. A: Papalutla fault as a major northeast trend structure that
accommodates deformation on south Mexico during Cretaceous
and Cenozoic time. B: Laramidian reconstruction for south Mexico
Ma—Maya; Mx—Mixteca; Ox—Oaxaca; SM—Sierra Madre. Overlap volcanic provinces: SMO—Sierra Madre Occidental; TMVB—Transmexican Volcanic Belt.


