

PS Belize - Onshore Stratigraphy and Renewed Onshore Petroleum Exploration Activity North of the 17th Parallel*

David T. King, Jr.¹ and Lucille Petruny¹

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¹Geology Office, Auburn University, Auburn, AL (kingdat@auburn.edu)

Abstract

Onshore stratigraphy of Belize, north of the 17th parallel, consists of (1) a thick section of deformed and metamorphosed Carboniferous-Permian sedimentary and volcanic strata in the Maya Mountains, (2) a moderately thick section of Mesozoic strata, mostly carbonates, which are found in the subsurface and in outcrop near the Maya Mountains and along major faults, and (3) a relatively thin section of Paleocene-Pleistocene carbonates, which comprise most of the coastal plain of northern Belize. There is a substantial regional unconformity separating pre- and post-Mesozoic strata. The Mesozoic-Cenozoic stratigraphic section of the Belize coastal plain has a moderately well-developed disconformity-bounded sequence stratigraphy. Of note, Belize has a thick K-T boundary section that consists of direct ejecta from the 170-km diameter Chicxulub impact crater in adjacent Mexico.

Recently renewed onshore petroleum exploration efforts in central Belize have shown that small scale anticlinal and fault-related features are important productive petroleum traps in that area. These geologic structures are related to tectonic stresses that affected the area beginning mainly during Cretaceous but continuing into Paleogene. The trend in orientation of these structures is north-northeast to south-southwest in the northern and central part of Belize, but the trend changes to more nearly east-northeast to west-southwest as these structures draw near to the Maya Mountains. The petroleum bearing units are the Hill Bank and Yalbac formations, but petroleum may reside in overlying units (Barton Creek and El Cayo carbonates) as well. Petroleum traps at the newly discovered Spanish Lookout Oil Field, and another new oil field nearby, are structural in nature. At this time, Spanish Lookout Oil Field is

producing approximately 5000 bbl/day, but may have the potential for perhaps as much as 7000 bbl/day. Seismic, aeromagnetic, and gravity data support the interpretation of similar basement-related, small scale anticlinal and fault structures in many areas within the main petroleum concessions of central Belize. This article reviews the onshore stratigraphy of northern Belize and the history and potential for petroleum production in the whole of central Belize.

Belize – Onshore Stratigraphy and Renewed Onshore Petroleum Exploration Activity North of the 17th Parallel

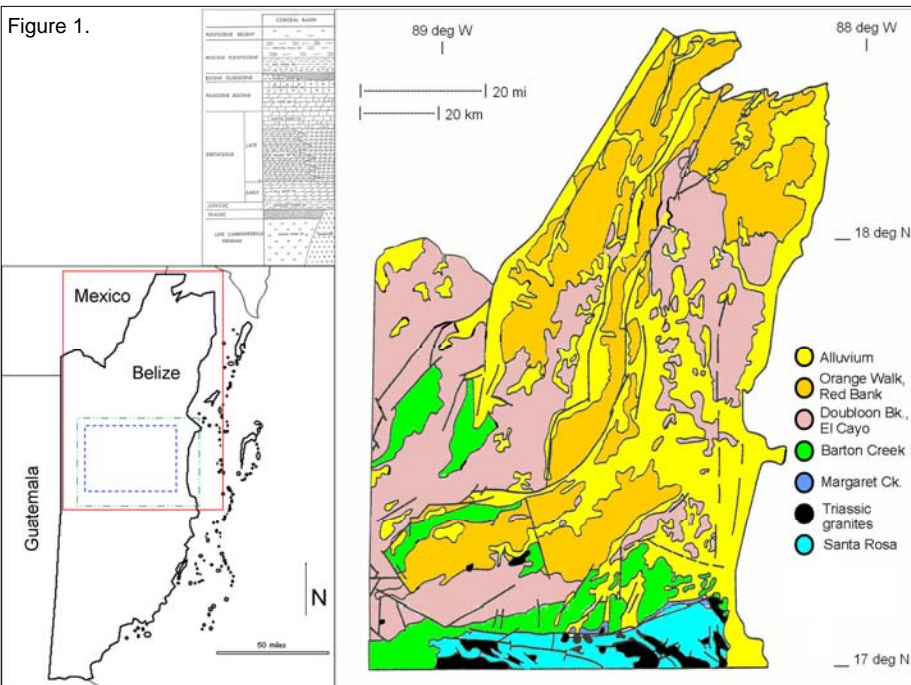
David T. King, Jr. and Lucille Petruny
 Geology Office, Auburn University, Auburn, Alabama 36849
 [kingdat@auburn.edu]

Onshore stratigraphy of Belize, north of the 17th parallel, consists of (1) a thick section of deformed and metamorphosed Carboniferous-Permian sedimentary and volcanic strata in the Maya Mountains, (2) a moderately thick section of Mesozoic strata, mostly carbonates, which are found in the subsurface and in outcrop near the Maya Mountains and along major faults, and (3) a relatively thin section of Paleocene-Pleistocene carbonates, which comprise most of the coastal plain of northern Belize (Fig. 1). There is a substantial regional unconformity separating pre- and post-Mesozoic strata. The Mesozoic-Cenozoic stratigraphic section of the Belize coastal plain has a moderately well-developed disconformity-bounded sequence stratigraphy. Of note, Belize has a thick K-T boundary section that consists of direct ejecta from the 170-km diameter Chicxulub impact crater in adjacent México.

Recently renewed onshore petroleum exploration efforts in central Belize have shown that small scale anticlinal and fault-related features are important productive petroleum traps in that area. These geologic structures are related to tectonic forces that affected the area beginning mainly during Cretaceous but continuing into Paleogene. The trend in orientation of these structures is north-northeast to south-southwest in the northern and central part of Belize, but the trend changes to more nearly east-northeast to west-southwest as these structures draw near to the Maya Mountains (Figs. 1 and 2). The petroleum bearing units are the Hill Bank and Yalbac formations, but petroleum may reside in overlying units (Barton Creek and El Cayo carbonates) as well.

Petroleum traps at the newly discovered Spanish Lookout oil field, and another new oil field (Never Delay) located nearby, are structural in nature. At this time, Spanish Lookout oil field is producing approximately 5000 bbl/day, but may have the potential for perhaps as much as 7000 bbl/day. Older (1908s-era) aeromagnetic, gravity, and seismic contour data support the interpretation of similar basement-related, small scale anticlinal and fault structures in many areas within the main petroleum concessions of northern Belize (Figs. 3-6).

Newer aeromagnetic and gravity data and results of new drilling and testing are held by concession owners and these data are released only when a concession is entirely relinquished back to the government. We provide here a brief overview of older data and maps that provide some background on the geologic situation in northern Belize.



← Figure 1. Geological map of Belize (modified from Cornec, 1986) with inset outline map of Belize showing the location of the geological map at right (red box), the aeromagnetic and gravity maps in Figures 4 and 5, respectively (green box), and the seismic contour map in Figure 5 (blue box). Upper left inset: stratigraphic column of northern Belize, specifically the Corozal Basin, from Cornec (1985).

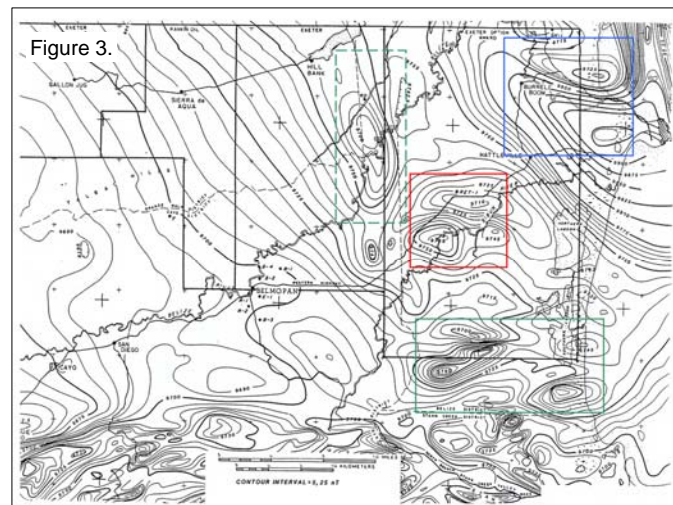
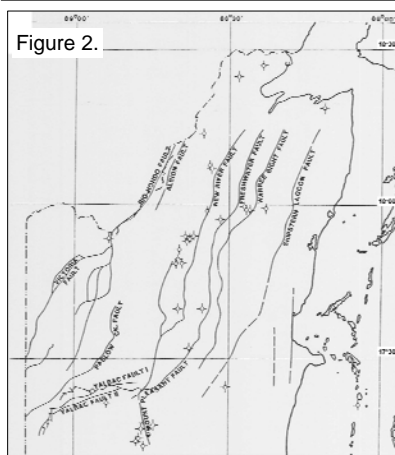


Figure 3. Map showing aeromagnetic contours at contour interval of 5.25 nT; taken from Morrice, 1988-90, who cite Barringer Geophysical Services of Golden, Colorado as the source for this map). The coast line of Belize is on the right and the map shows boundaries between districts, main highways, and main rivers for reference. In addition, several of the key wells drilled prior to 1990 are shown (for example, Y is Yalbac #1 and the Belmopan wells (B-n) and the Roaring Creek wells (R-n) are marked) and some towns are marked as well. The boundaries of the former Exeter and Rankin Oil concessions are shown. We have added a red box around the lower Sibun River aeromagnetic anomalies (see also this box on Figure 4), a blue box around the Burrell Boom anomalies, a green box around the group of anomalies near the Southern Lagoon area, and a dashed green box around the Belize River anomaly. The approximate location of the whole of this map area is shown in Figure 1.



← Figure 2. Map of fault controlled escarpments of northern Belize and the location of some wells drilled up to November, 1987 (from Stoakes-Campbell, 1987).

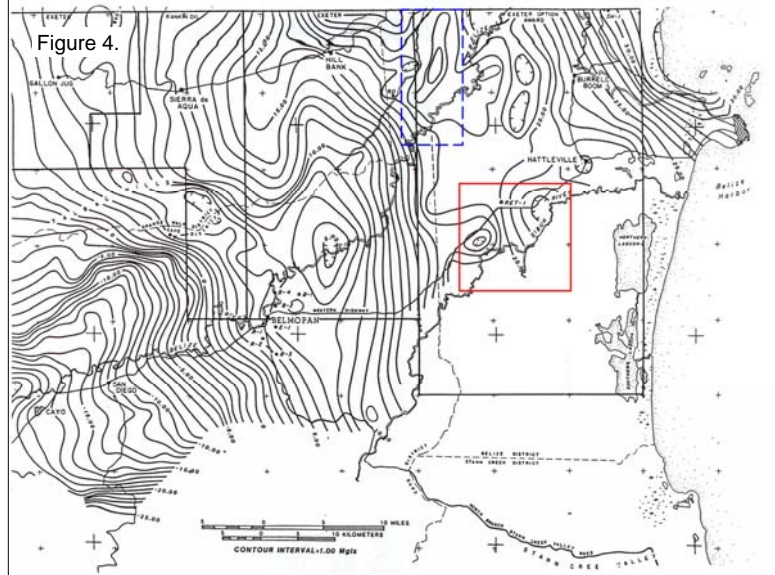


Figure 4. Map showing the Bouguer gravity contours at a contour interval of 1.00 milligals (Mgls; taken from Morrice, 1988-90, who cite Barringer Geophysical Services of Golden, Colorado as the source for this map). The coast line of Belize is on the right and the map shows boundaries between districts, main highways, and main rivers for reference. In addition, several of the key wells drilled prior to 1990 are shown (for example, Y is Yalbac #1 and the Belmopan wells (B-n) and the Roaring Creek wells (R-n) are marked) and some towns are marked as well. The boundaries of the former Exeter and Rankin Oil concessions are shown. We have added a red box around the lower Sibun River gravity anomalies and a blue dashed box around the East Rancho Dolores gravity high that is indicated by Morrice (see Figure 5). The approximate location of the whole of this map area is shown in Figure 1.

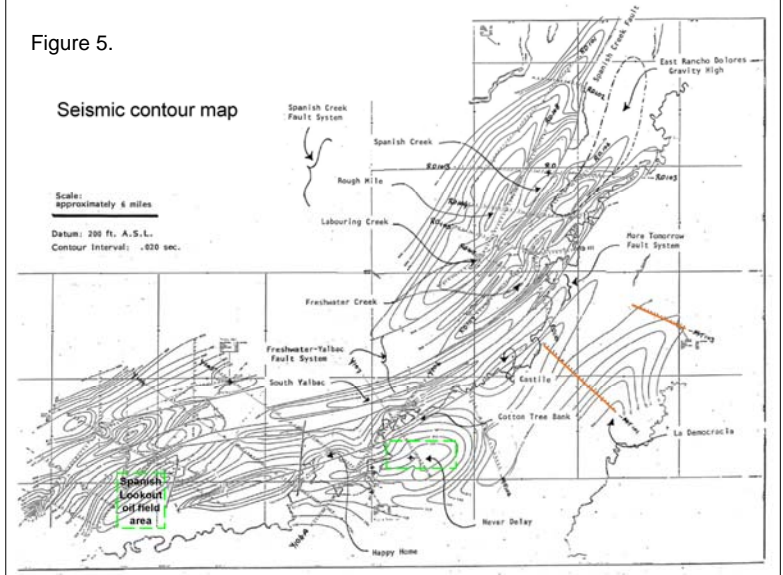
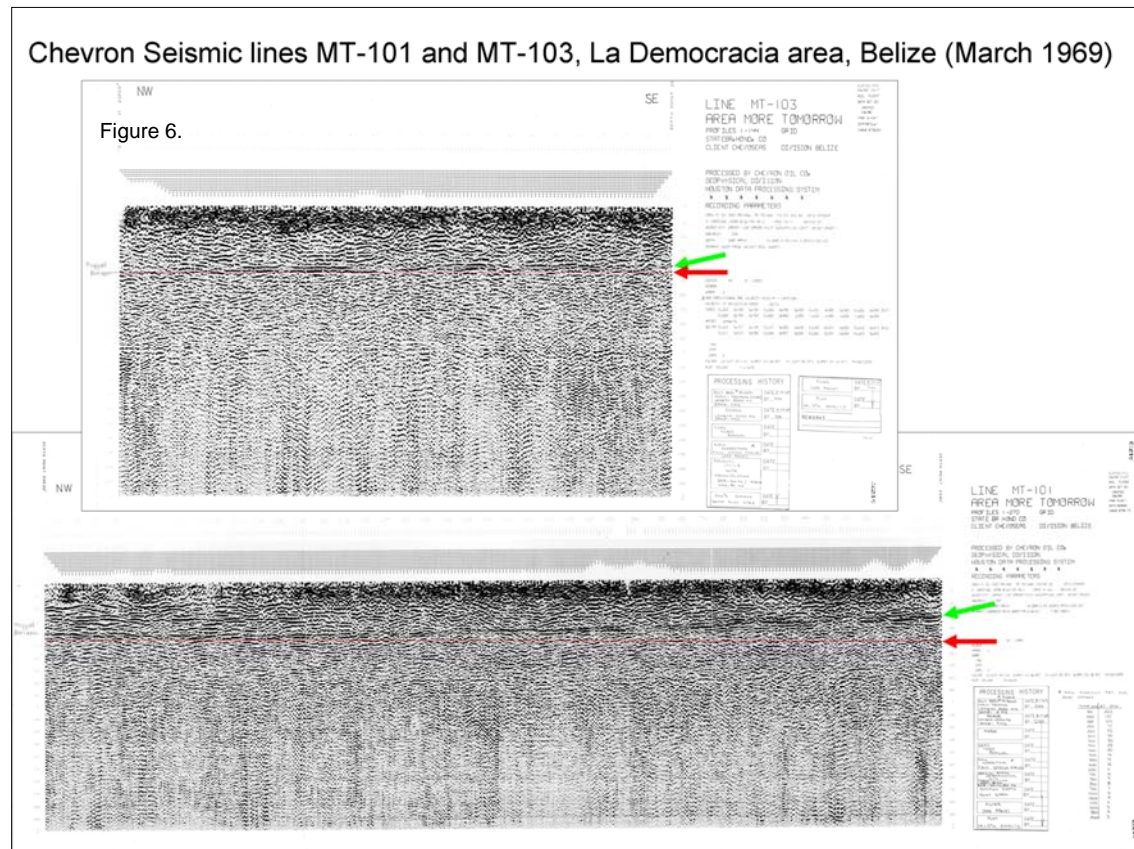


Figure 5. Map showing the seismic contours at a contour interval of 0.20 sec (taken from Morrice, 1988-90, who cite a 1970 Chevron report as the source for this map). This represents the 1970 state-of-the-art "seismic interpretation of the structure at the base of the carbonate section" (i.e., at the base of the Yalbac formation) for the Belmopan-Yalbac-Rancho Dolores area. Morrice added the names of some of the main faults of northern Belize that are evident on this map (for example, the Spanish Creek fault and the More Tomorrow fault system). The Freshwater-Yalbac fault system also appears on Figure 3. The names of key towns and settlements adjacent to seismic structures are noted, including Never Delay and La Democracia. Locations of seismic lines (MT, RD, and Y) are shown, including the seismic lines that appear in Figure 6, MT-101 and MT-103 (orange lines). The approximate location of Spanish Lookout oil field and Never Delay oil field has been added by us (green dashed boxes). The East Rancho Dolores gravity high, evident on Figure 4, is marked for reference. The approximate location of the whole of this map area is shown in Figure 1.



← Figure 6. Chevron Seismic lines MT-101 and MT-103 in the La Democracia area, Belize. These lines were shot during March, 1969, by Chevron Oil Company and they were used to estimate the seismic contours at the structure LA La Democracia on Figure 5. The red arrows point to a reference horizontal line and the green arrows point to the rising reflector that shows the structure.

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