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# El ‘fracking’ no es la causa de la alta sismicidad en el suroeste de Puerto Rico (diciembre 2019 – enero 2020) [1]

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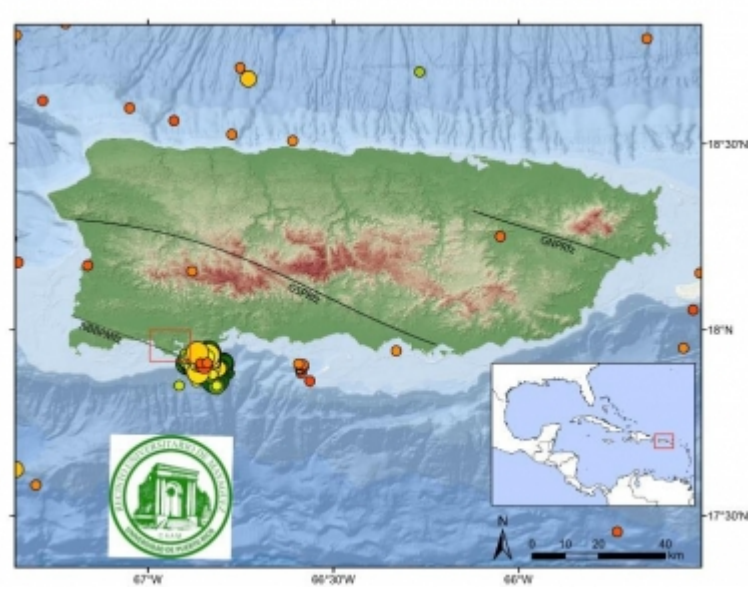
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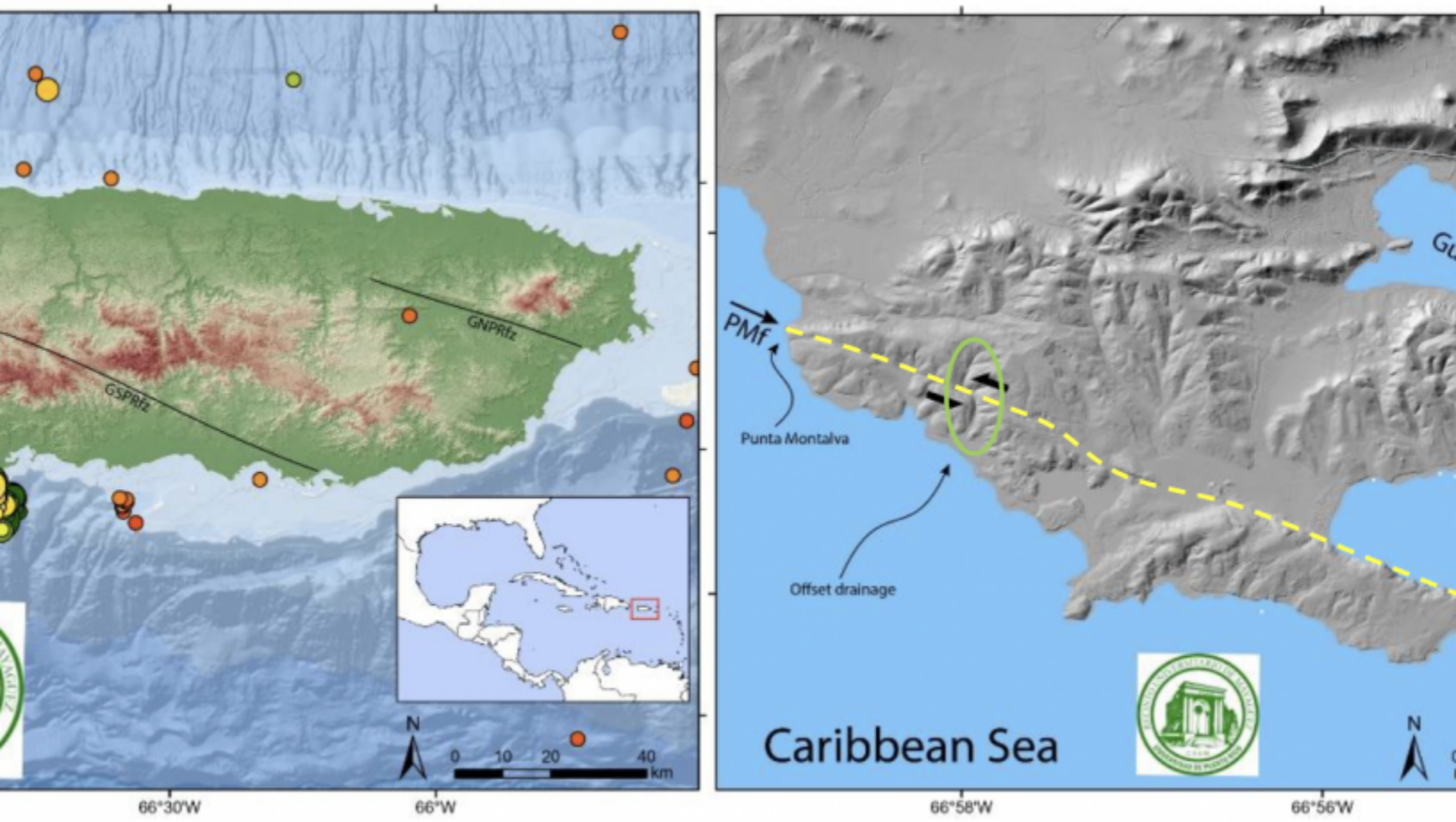
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As professionals and experts in the field of Geology, we wish to issue a prompt and concise opinion on 'fracking' as a potential trigger for the seismicity experienced in Puerto Rico (PR) since December 28, 2019. This article must address any concerns on the subject and allow for a responsible discussion.

The term fracking or hydraulic fracturing, refers to the practice of using water, various chemical components and sand injected under pressure to fracture rocks that contain liquid oil or some natural gas. Fracking has been identified as a trigger for earthquakes in several regions of the world including the United States (link [3]).

However, fracking is NOT the cause of the earthquakes occurring in PR for the following reasons:

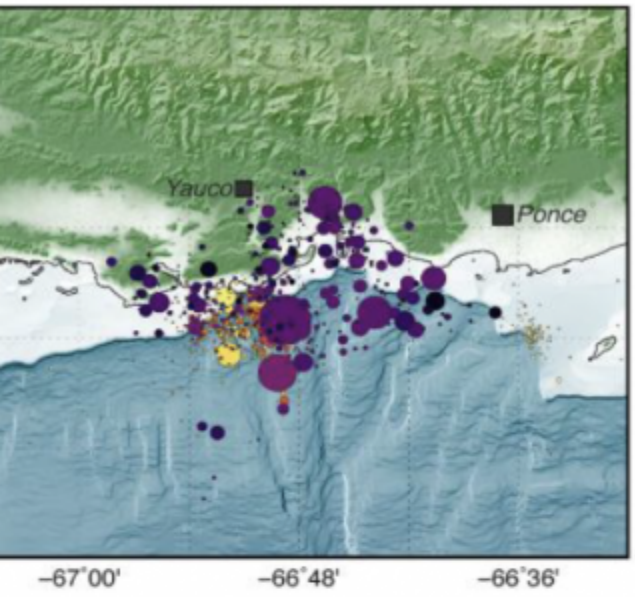
1. The seismic pattern is consistent with pre-existing geological faults: The location of the earthquake epicenters from December 28, 2019 until January 27, 2020 are aligned with a zone of clearly identifiable geological faults in the landscape (see images below). The geological fault of Punta Montalva is not new and is identified in previous geological studies (link [4]). Part of this fault appears to have had a net displacement of up to 5.5 inches because of recent earthquakes (link [5]).

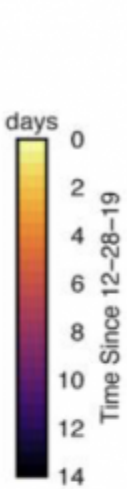


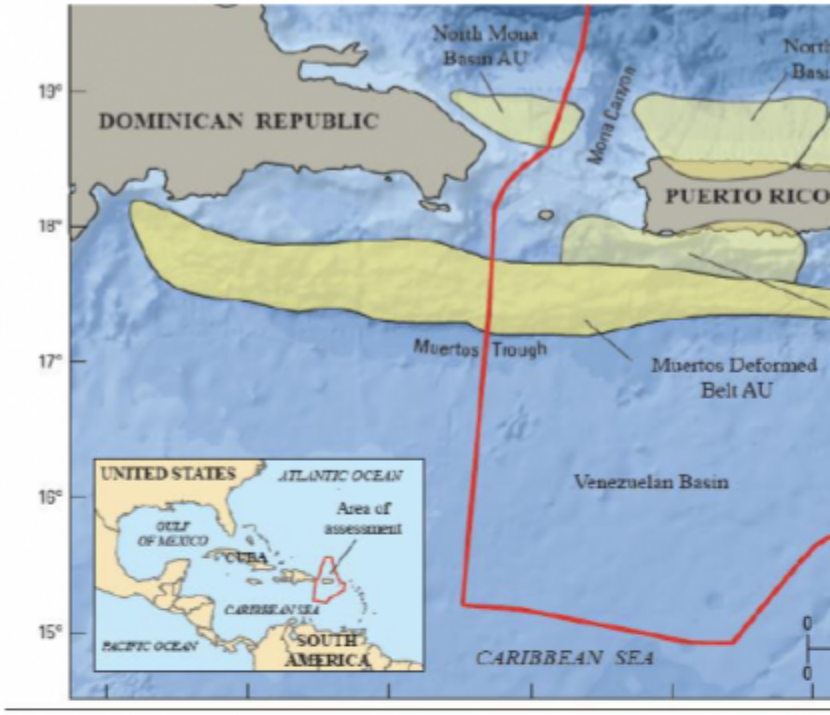

*Above left*: Map displaying some active geological faults in Puerto Rico. The fault identified as NBBPMfz is the fault called "North Boquerón Bay-Punta Montalva Fault System". The map also demonstrates the location of the epicenters that have been identified from December 2019 to early January 2020. *Top right*: Hillshade-style map of the area between Punta Montalva and Guánica Bay that demonstrates the obvious geomorphological manifestation that the fault has drawn in the landscape. These manifestations include a depression in the axis of the fault (broken yellow line) and cracks whose alignment has been displaced (green oval). This evidence was already present prior to the recent seismic sequences and requires thousands of years of seismic activity [Maps by Lopez et al. (2010); link [6]].

1. Null potential for gas and oil extraction in the area of seismic activity: The United States Geological Survey (USGS) identified a reservoir with potential (undiscovered) for the extraction of natural gas and oil in his Fact Sheet 2013-3101 (link [7]). The area with potential for extraction was identified as ‘Dead Deformed Belt Assessment Unit’ (AU). This area does not correspond with the area where the earthquake epicenters have been located (see images below). The area where the earthquakes have been located is within what the USGS called the ‘South Coast

Basin AU’. In this area, the USGS determined that there is a very low probability of removable gas or oil. With such a low probability of containing oil or gas that can be extracted and without a more formal potential evaluation, it is not feasible to even begin drilling exploratory wells and much less to initiate the process of extraction by 'fracking' or any other method. The study also determined that there is no extraction potential within the coasts of Puerto Rico.




**le 1.** Puerto Rico–U.S. Virgin Islands Exclusive Economic Zone assessment results.

MBO, million barrels of oil; BCFG, billion cubic feet of gas; MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. accumulations, all liquids are included as NGL (natural gas liquids). Undiscovered gas resources are the sum of nonassociated gas (gas in gas accumula associated gas (gas in oil accumulations). F95 represents a 95-percent chance of at least the amount tabulated; other fractiles are defined similarly. Fract additive under the assumption of perfect positive correlation. TPS, Total Petroleum System; AU, Assessment Unit. Gray shading indicates not applicable

| *tal Petroleum Systems PS)* *d Assessment Units (AU)* | AU Proba-bility | Field Type | *Total Undiscovered Resources* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Oil (MMBO)* | | | | *Gas (BCFG)* | | | | *NGL (MMBNGL)* | | |
| | | | F95 | F50 | F5 | Mean | F95 | F50 | F5 | Mean | F95 | F50 | F5 |
| **leogene TPS** | | | | | | | | | | | | | |
| orth Coast Basin AU 1170201) | 0.04 | *Oil* | Not quantitatively assessed | | | | | | | | | | |
| | | *Gas* | | | | | | | | | | | |
| an Juan Basin AU 1170202) | 0.04 | *Oil* | Not quantitatively assessed | | | | | | | | | | |
| | | *Gas* | | | | | | | | | | | |
| orth Mona Basin AU 1170203) | 0.02 | *Oil* | Not quantitatively assessed | | | | | | | | | | |
| | | *Gas* | | | | | | | | | | | |
| **leogene TPS** | | | | | | | | | | | | | |
| outh Coast Basin AU 1160201) | 0.008 | *Oil* | Not quantitatively assessed | | | | | | | | | | |
| | | *Gas* | | | | | | | | | | | |
| **pper Cretaceous-Tertiary TPS** | | | | | | | | | | | | | |
| uertos Deformed Belt AU 1160101) | 0.20 | *Oil* | 0 | 0 | 120 | 19 | 0 | 0 | 236 | 39 | 0 | 0 | 9 |
| | | *Gas* | | | | | 0 | 0 | 1,296 | 205 | 0 | 0 | 30 |
| **tal conventional esources** | | | 0 | 0 | 120 | 19 | 0 | 0 | 1,532 | 244 | 0 | 0 | 39 |

*Top left: Image taken from Laustsen (2020; link [8]) shows the distribution of the earthquakes felt in the southwest of PR between December 28, 2019 and January 9, 2020. Top right: Image taken from " USGS Fact Sheet 2013-3102 '(link [7]). Table from 'USGS Fact Sheet 2013-3102'*.

2. Lack of evidence of permits and investments: There is no evidence of requests for exploration permits to confirm any of the units (AU's), much less permits to extract them. This is a process regulated by multiple state and federal agencies (such as the Department of Natural and Environmental Resources, the Environmental Quality Board, the Environmental Protection Agency and the Bureau of Ocean Energy Management) that takes years and costs millions of dollars to complete (link [9]). Among other things, the process involves public hearings that would attract a lot of media coverage. None of this has happened. Nor is there evidence of investors involved in the extraction of oil or gas in PR. The magnitude of the investments required for any oil or gas extraction process is always openly announced since these are companies that participate in the stock market and are required by law to make their investments public. An example of it are the companies that extract oil in Trinidad and Tobago such as the Trinity Exploration & Production Company (link [10]).

3. Lack of evidence of needed fracking infrastructure: There is no physical evidence that gas or oil extraction is occurring near PR or the US Virgin Islands. This type of effort requires the platforms that are typical in the Gulf of Mexico, near the Texas coast, and on the California coasts (see photos below).



*Above left: Photo of oil platforms taken from the shores of Port Aransas in Texas (link [11]). Above right: Photo of platforms used for fracking on the California coasts (link [12]).*

4. Puerto Rico is not listed databases documenting where fracking occurs: There is no documented evidence of fracking occurring in Puerto Rico from organizations dedicated to monitoring this practice worldwide. An example of this is the Fractracker Alliance (link [13]).

5. Lack of evidence in databases of the US Energy Information Administration (EIA): According to its website, the US Energy Information Administration (EIA) "*collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment*" ( link [14]). We understand that this is the most complete database that exists on energy issues for the US and its Territories. The database contains information on all aspects related to energy, including oil and gas extraction, transportation and processing; in addition to information on electricity production, among others. At the end of this document, we have included maps (source: link [15]), a table (link [16]), and analysis (link [17]) related to PR and the US in general, with some details of the State of Texas for comparison purposes. The database clearly indicates that no type of gas or oil extraction is occurring in PR, and that, although geological units with the

potential to extract gas have been identified, currently there are no confirmed reserves in Puerto Rico, additionally the island neither produces or refines nor gas nor oil.

**Summary**: As already determined by experts from both, PR and the Continental US, the seismic sequences occurring in the current weeks are caused by natural geological processes (link [18]). Puerto Rico lies in a highly seismic zone, near the tectonic margin between the Caribbean Plate and the North American Plate. These plates slide in relation to each other and this relative movement is what causes the earthquakes. Numerous seismic events occur daily in the vicinity of Puerto Rico but most are usually small and undetectable to the population. The high seismicity in Puerto Rico that began at the end of December 2019 is unusual for this fault zone (link [19]), but consistent with the natural geological scenario of the island and the cyclic behavior of geological faults (link [20]).

For questions you can write to: cramos_scharron@yahoo.com [21] For Spanish version: link [22]

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