

This manuscript is quite substantial in content and provides relevant analysis from a novel perspective. It focuses on the microscale mechanical properties of the marine shale of the WF-LMX Formation and how these mechanical properties are related to sedimentary conditions. Overall, the manuscript is well organized, the expression of the results is clear enough, and the key points are highlighted. I propose to accept it with some modifications.

1. Line 251. Why do you use 7×7 grid indentations? What is your basis for that or do you have any references?
2. Line 250-258. Does your shale exhibit a laminated texture? If the shale is of the laminar type, the method used to determine its bulk mechanical properties may not be appropriate. This is because some laminae within it can be several centimeters thick.
3. The indents in Fig.3 are not clear. Please mark them on the figure.
4. Figure 4. EDS only gives elemental distributions. How exactly was mineralogy determined, knowing that many minerals can have identical Si/O distributions?
5. Figure 5 displays the load-displacement curves on fracture areas. Do you use these data for statistical mechanical analysis? If not, please provide an explanation.
6. Line 406-410. Since this is the results section, do not include any analysis or discussion; just present the obtained results directly.
7. Table 2 is not of much significance in the main text and can therefore be placed in the Supplementary Files.
8. Line 517, Please provide references. Actually, it would be better to include data on trace elements in section 5.1.4. Please provide more literature to support the explanations in this part.
9. Line 574. It is well known that the fracture toughness of shale increases with increasing clay content. However, in your study, fracture toughness is positively related to hardness and Young's modulus. Can you explain why?
10. Lines 635-638. Traditional uniaxial/triaxial compression tests can also predict mechanical parameters for both the X1 and X3 planes. However, it is important to emphasize the advantages offered by nanoindentation techniques.