

MAPPING OF A THICK SEDIMENTARY COVER FOR MINERAL EXPLORATION AT THE SOUTHERN BENUE TROUGH OF NIGERIA FROM A SYNTHETIC BOUGUER GRAVITY DATA

Apeh, O.I.^{1,2}; Tenzer, R.¹; Pham, L.T.³, Moka, E.C.², & Onah, E.U.²

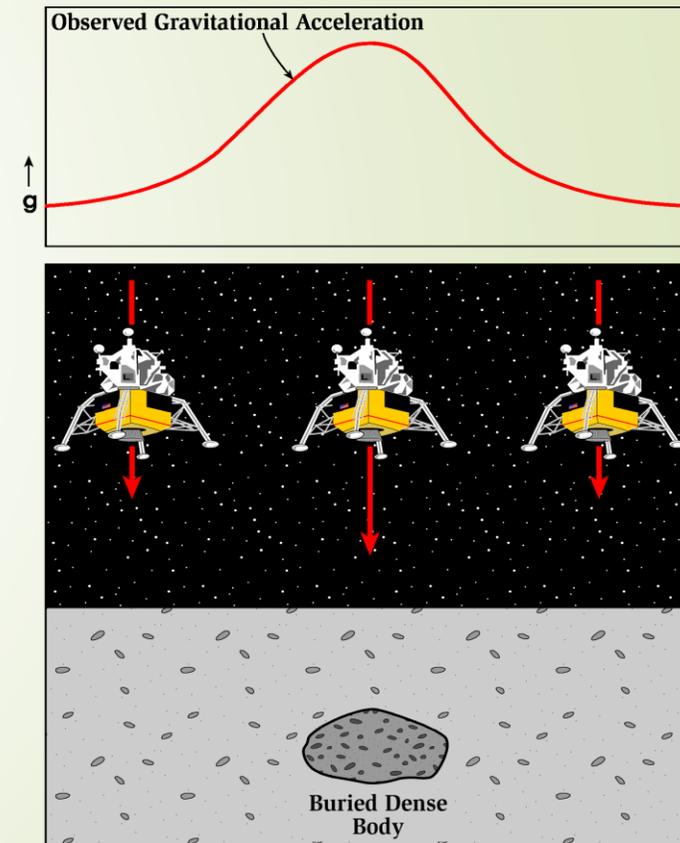
¹The Hong Kong Polytechnic University, Hong Kong

²University of Nigeria, Enugu Campus, Nigeria

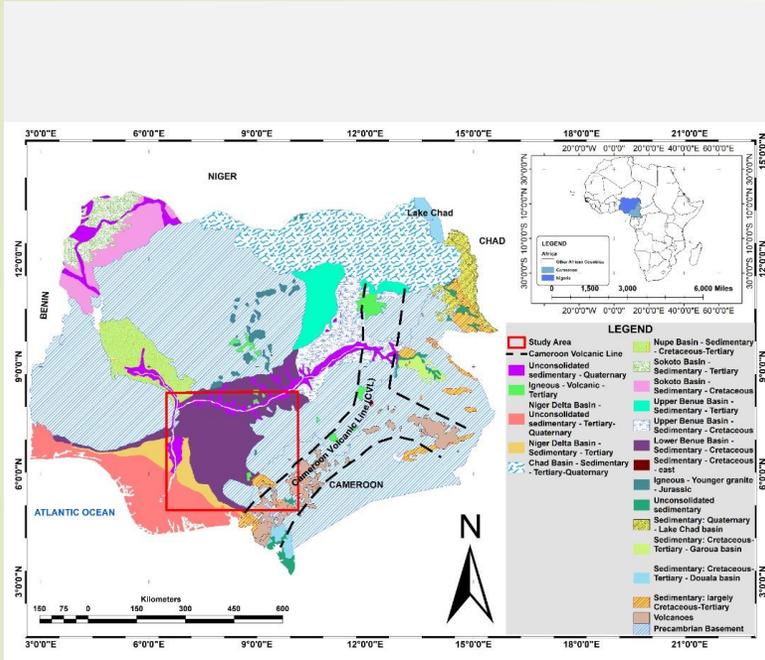
³University of Science, Vietnam National University, Vietnam

December 12, 2023

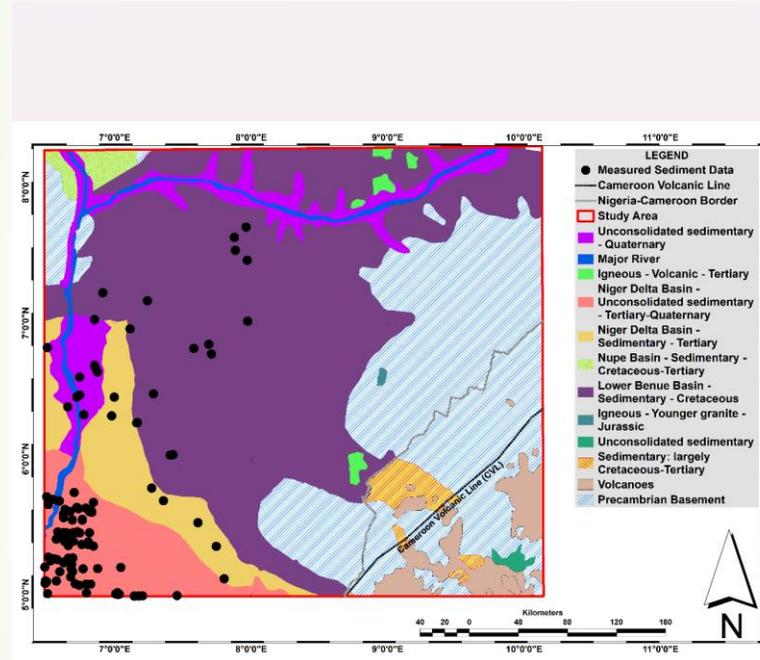
Ojima.apeh@connect.polyu.hk



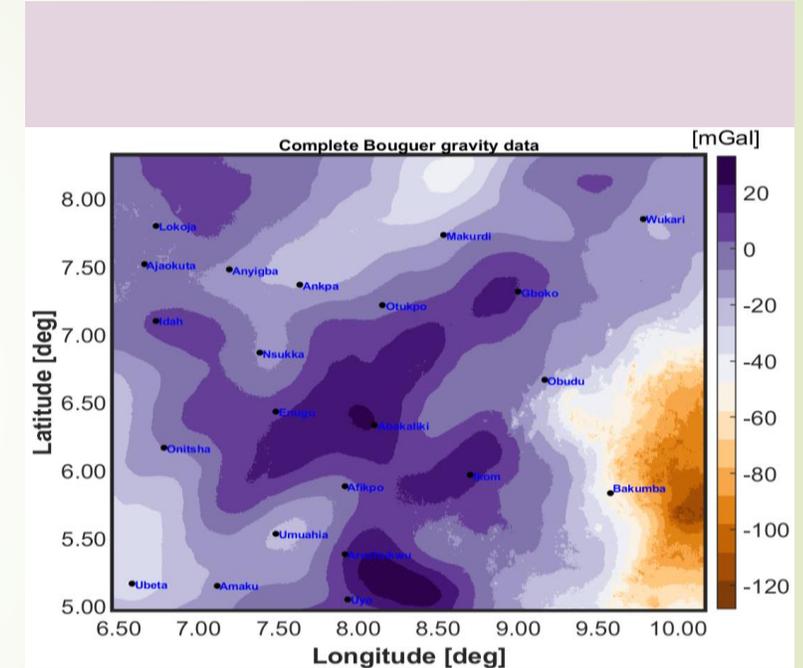
Aim: to estimate sediment thickness by employing a high-resolution synthetic gravity data and logged borehole data within a highly rifted continental plate.



Generalized geology of the study area

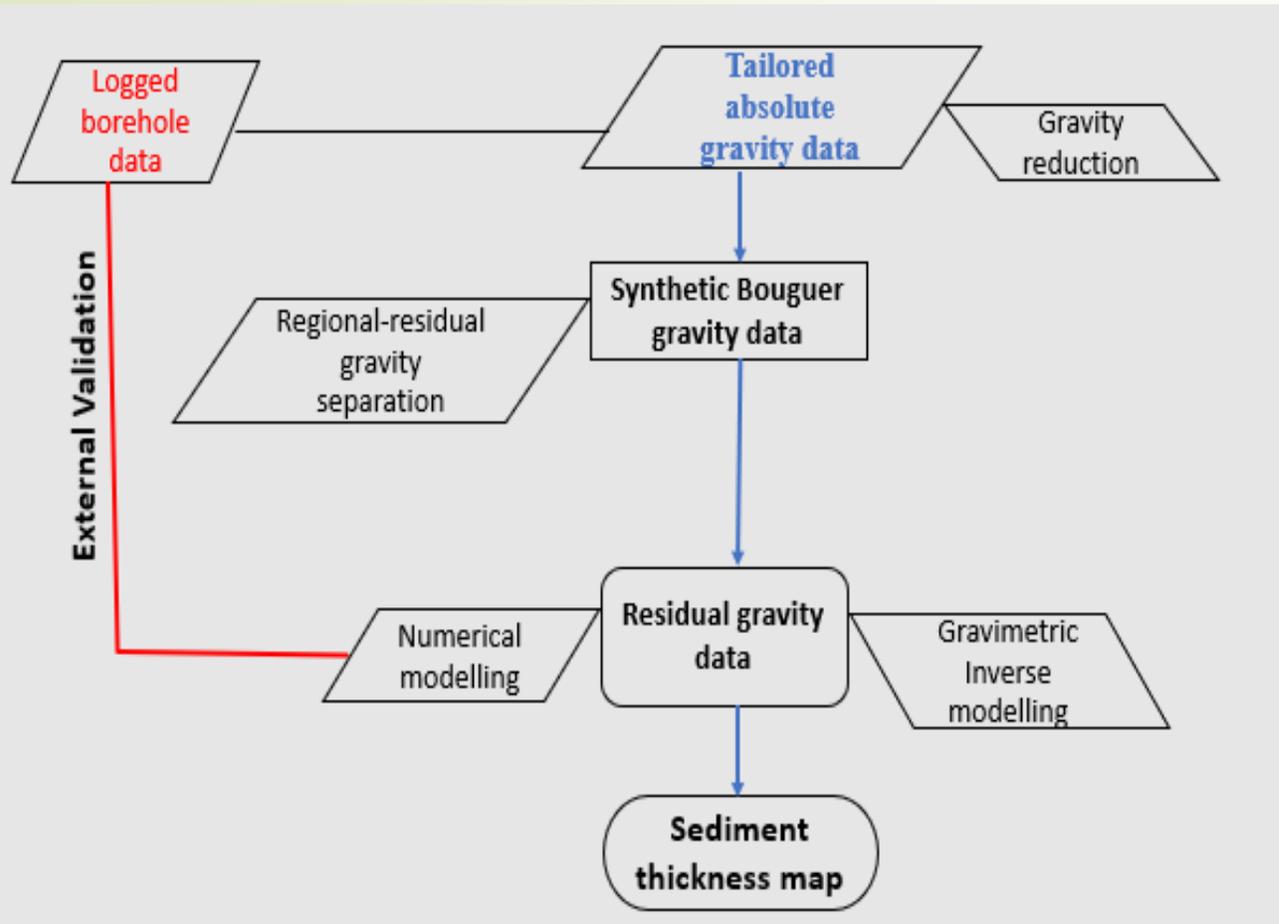


113 Logged Borehole data



High-resolution Bouguer gravity data

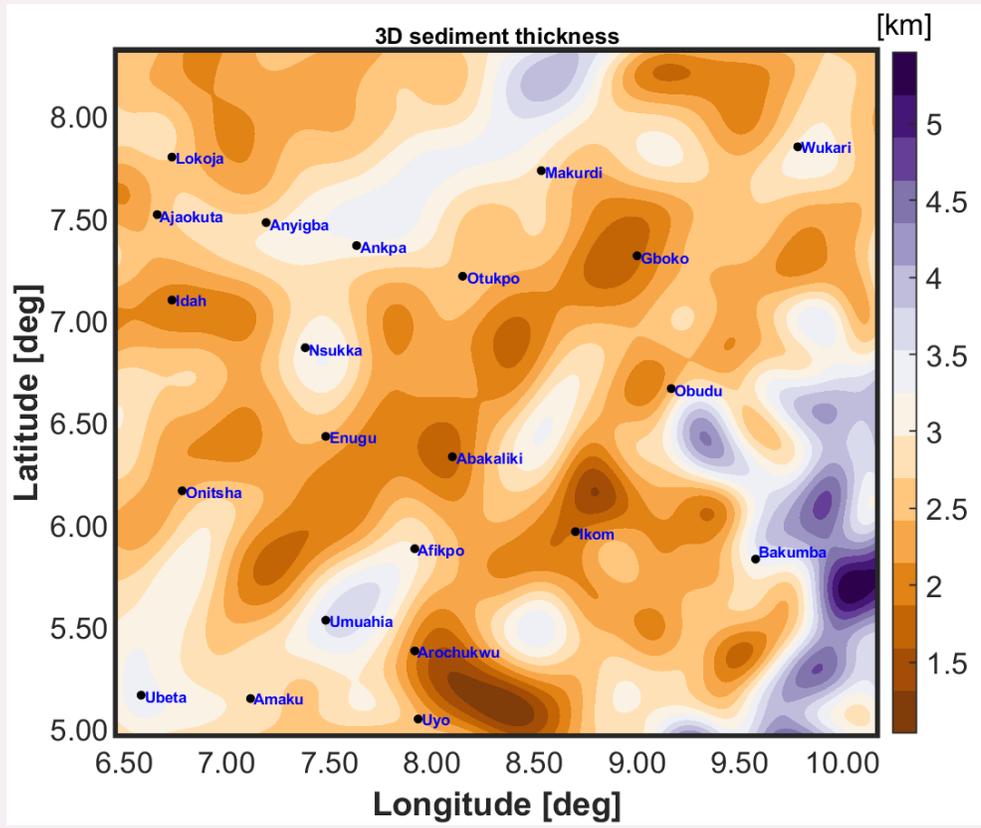
Methods: We computed a residual gravity data and utilized a numerical modelling procedure to ascertain optimal gravimetric inversion parameters for the entire study area



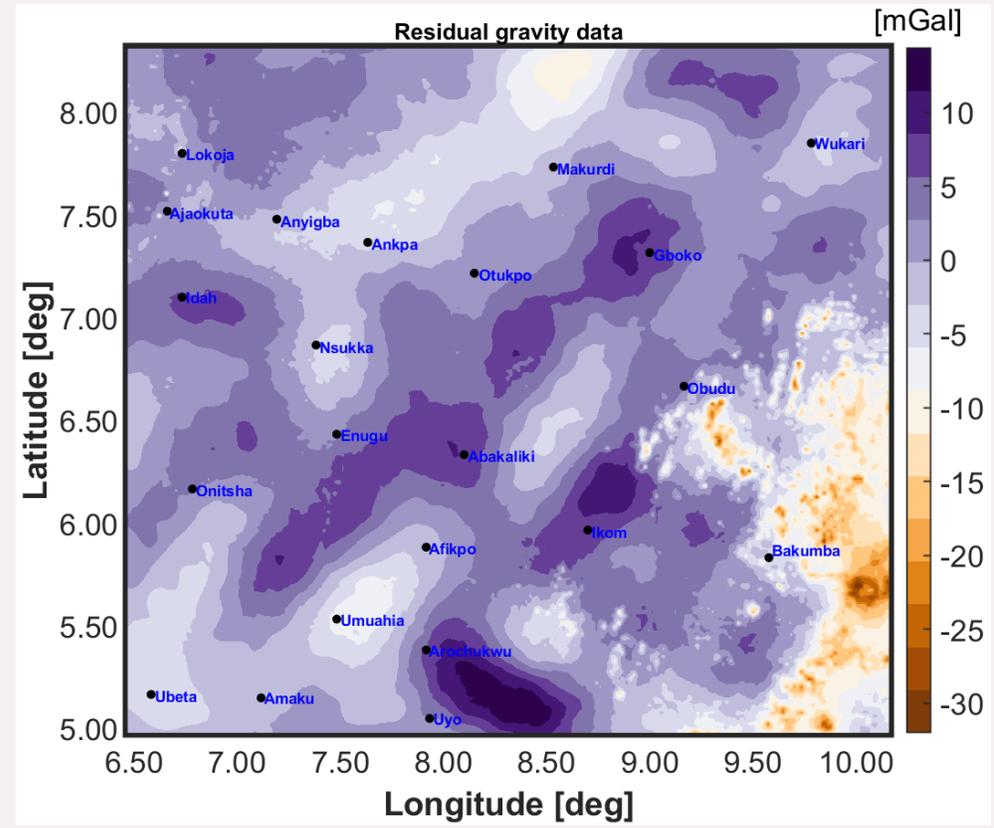
RMS of differences based on selected gravimetric inversion parameters

Mean sediment depths (km)	Density contrasts (gcm ⁻³)													
	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.37
	RMS of residuals													
0.0	2.73	2.77	2.81	2.83	2.86	2.88	2.89	2.9	2.92	2.93	2.94	2.94	2.95	2.96
0.3	2.44	2.48	2.52	2.54	2.57	2.58	2.6	2.61	2.63	2.64	2.65	2.65	2.66	2.67
0.6	2.16	2.20	2.23	2.26	2.28	2.30	2.31	2.33	2.34	2.35	2.36	2.37	2.38	2.38
0.9	1.89	1.92	1.95	1.98	2.00	2.02	2.03	2.05	2.06	2.07	2.08	2.09	2.09	2.10
1.2	1.62	1.65	1.68	1.70	1.72	1.74	1.76	1.77	1.78	1.79	1.8	1.81	1.82	1.83
1.5	1.38	1.40	1.42	1.44	1.46	1.48	1.49	1.51	1.52	1.53	1.54	1.55	1.55	1.56
1.8	1.17	1.17	1.19	1.20	1.22	1.23	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.31
2.1	1.01	0.99	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.08	1.09
2.4	0.92	0.88	0.87	0.86	0.86	0.87	0.87	0.88	0.89	0.89	0.9	0.91	0.91	0.92
2.7	0.94	0.87	0.84	0.82	0.81	0.80	0.80	0.80	0.81	0.81	0.81	0.81	0.82	0.82
3.0	1.05	0.97	0.92	0.89	0.87	0.85	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83
3.3	1.23	1.14	1.08	1.04	1.01	0.99	0.98	0.97	0.96	0.96	0.95	0.95	0.95	0.94
3.6	1.46	1.36	1.30	1.25	1.22	1.20	1.18	1.17	1.16	1.15	1.14	1.14	1.13	1.13

Findings: Our sediment thickness map depicts a prevailing southwest trend of increasing sediment thicknesses, while decreasing eastward and also demonstrating the various tectonic events within the entire study area



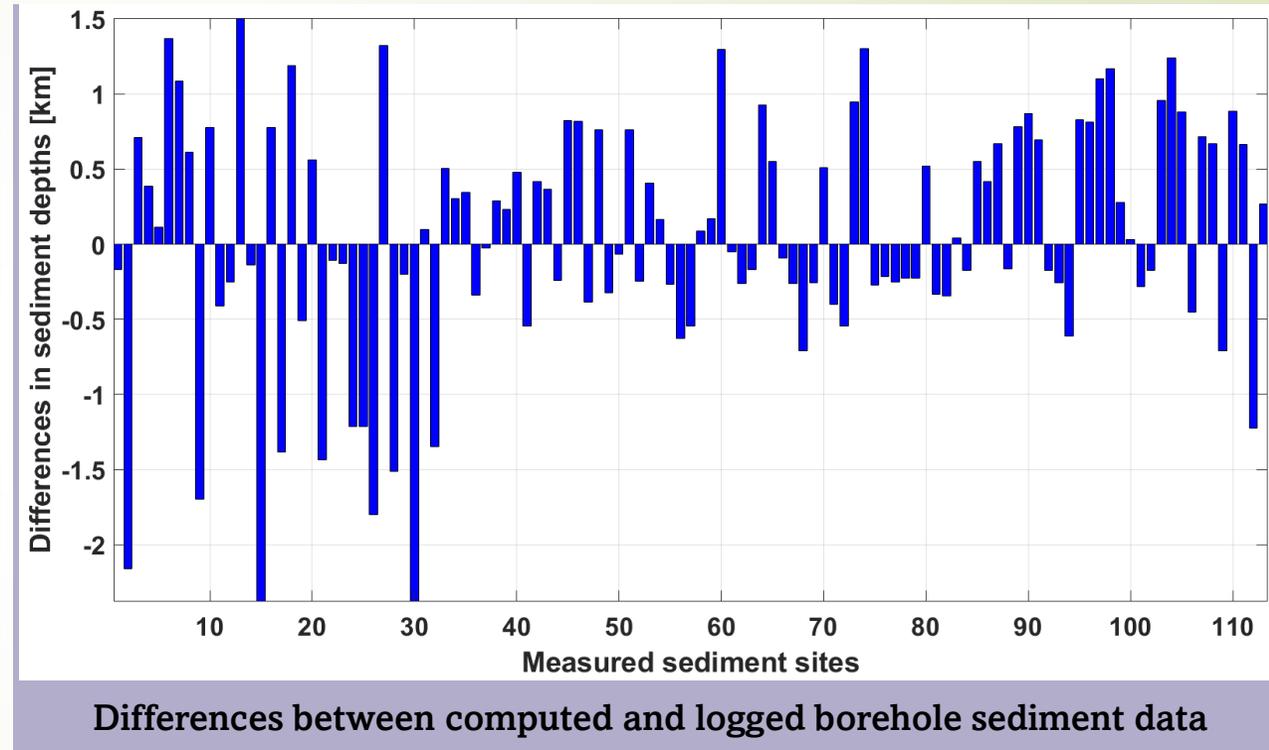
Sediment thickness map of the entire study area



Structure of the crust from our residual gravity map

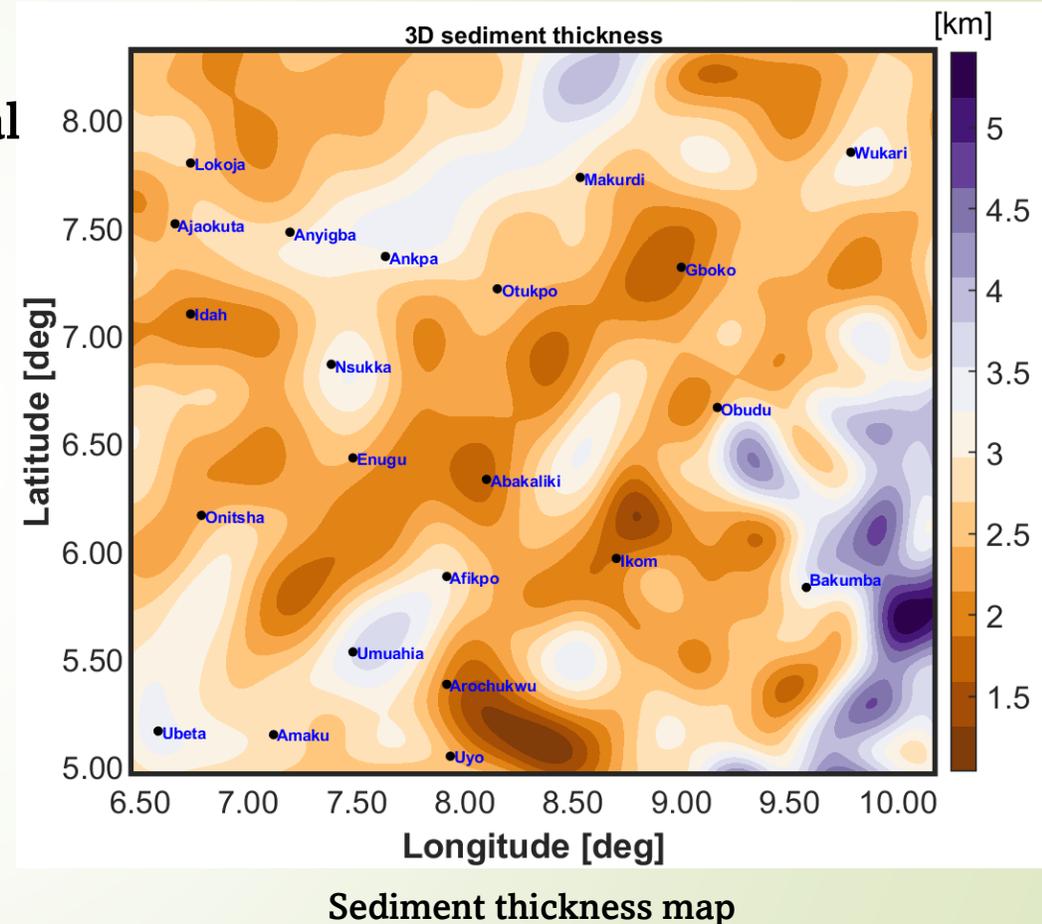
Findings: Our estimated sediment thickness map is consistent with the available logged borehole data and other localized estimates from previous studies

Data for the analysis	Results	Authors
Borehole and gravity data	Maximum of 4.5-5km	Adighije (1976; 1979; 1981a; 1981b)
Surface geology	3.3km for the Albian shales	Kogbe (1976)
Aeromagnetic data	1.3-2.5km within the Anticlinorium	Ofoegbu and Onuoha (1991)
Aeromagnetic data	1.0-4.0km	Obi et al. (2010)
Aeromagnetic data	Maximum of 4.4-4.9km	Oha et al. (2016)

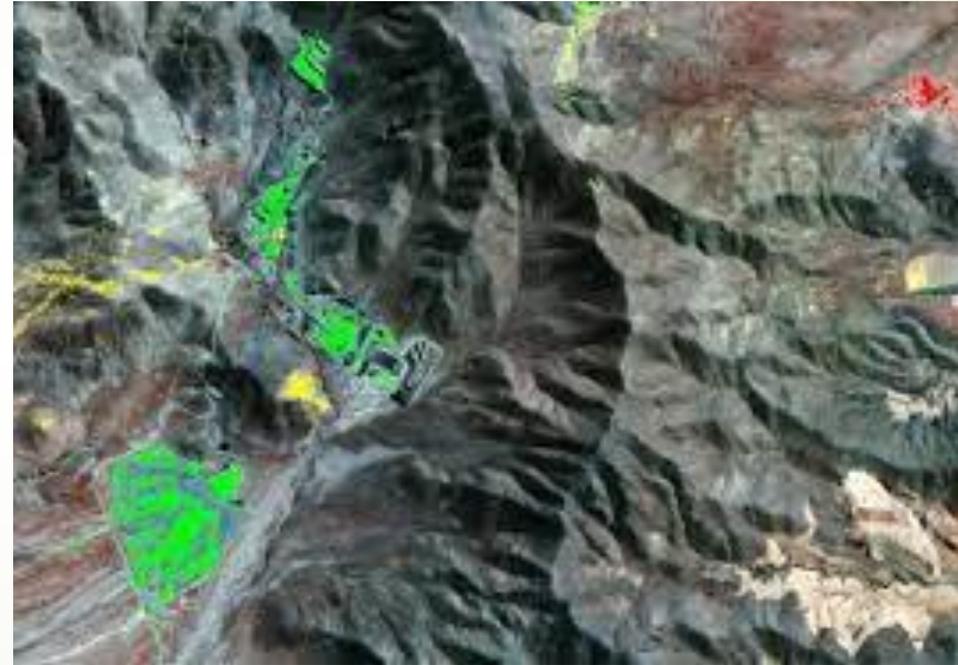


Implications of the sediment thickness map to mineral exploration

- Thick sedimentary covers within the study area may have been so compacted or compressed to generate adequate heat and pressure for the maturation of several mineral resources in this region.
- Presence of synclines and anticlines indicate compressional and extensional tectonic regimes which could pave way for hydrothermal fluid migration
- Areas with shallow sediments may be good habitats for ore bodies uplifted as a result of magmatism
- There is the likelihood of sediments been entrapped within and under the uplifted crust, which may have matured (because of high temperatures) overtime into mineralization hotspots.



- Summary:** *the newly compiled sediment thickness map is a good resource for mineral exploration activities
- *our methodology could be beneficial for developing countries and regions with insufficient coverage of borehole or seismic data.



THANK YOU