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Research Article

Identification of Gas Sand Horizons of the Rashidpur Structure, Surma Basin, Bangladesh, Using 2D Seismic Interpretation

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A total of 13 seismic sections were used for 2D seismic interpretation in order to assess the subsurface geometry of gas sand horizons and hydrocarbon prospect of the Rashidpur structure, Surma Basin, Bangladesh. Out of five reflectors, two selected reflectors were mapped for the study. The top of the Upper Gas Sand (R3) reflector was elongated in N-S with the axis swinging slightly to the east on the northern plunge. North-South trending thrust fault was identified in the eastern part which is parallel to the axial line of the structure. The reflection patterns of the gas sand horizons were parallel to each other and similar in nature. The reflection coefficients were positive at the base and negative at the top of the each gas sand horizons. Velocity dropped from 2562 m/s to 2177 m/s in the Upper Gas Sand (R3) and 4320 m/s to 3413 m/s in the Lower Gas Sand (R5) reflector. Bright spot and amplitude anomalies were identified on the top of the both gas sand horizons. The result depicts that the shape of the gas sand horizons is asymmetric anticline. The structure is compressed and elongated NNW-SSE trending anticline. The study reveals hydrocarbon potentiality of the structure.

1. Introduction

Seismic structural study examines the nature and geometry of the subsurface geology [1]. Seismic study is a common practice to interpret subsurface structure and potentialities of hydrocarbon exploration [2, 3]. Some authors have made valuable contributions in different hydrocarbon-bearing structure of Surma Basin, Bangladesh, in different time by seismic analysis [4–8]. Few works have also done by hydrocarbon aspects of Bengal Basin, Bangladesh [9–12]. The Rashidpur structure was discovered by the Pakistan Shell Oil Company (PSOC) in 1960. Hossain [13] carried out the study on the application of common depth point shooting of the Rashidpur structure, Surma Basin, Bangladesh. The earlier study was focused on the geophysical interpretation of the Rashidpur structure [14]. The present study emphasized on gas sand horizons to interpret detailed subsurface geometry and to delineate the minor fault of the structure. Different companies carried out seismic study of the structure due to their own commercial purposes. In the study, attempts have been made to incorporate with seismic structural interpretation and hydrocarbon prospects of the Rashidpur structure. The main objective of the study was to map in detail the gas sand horizons and hydrocarbon potentialities of the Rashidpur structure. The Rashidpur structure is situated in the south central part of the Surma Basin under Bahubal Upazila of Habiganj District, Bangladesh (Figure 1).

2. Geology of the Structure

Bengal Basin is a prolific hydrocarbon-bearing basin in Southeast Asia. Actually, Surma Basin is a subbasin of Bengal Basin of Bangladesh. The Surma Basin is the northeastern continuation of the Bengal Foredeep and an area of later tectonics than Bengal Basin itself [15]. The Surma Basin is the most important in terms of sediment thickness probably exceeds 20 km and economic deposits [16]. The Surma

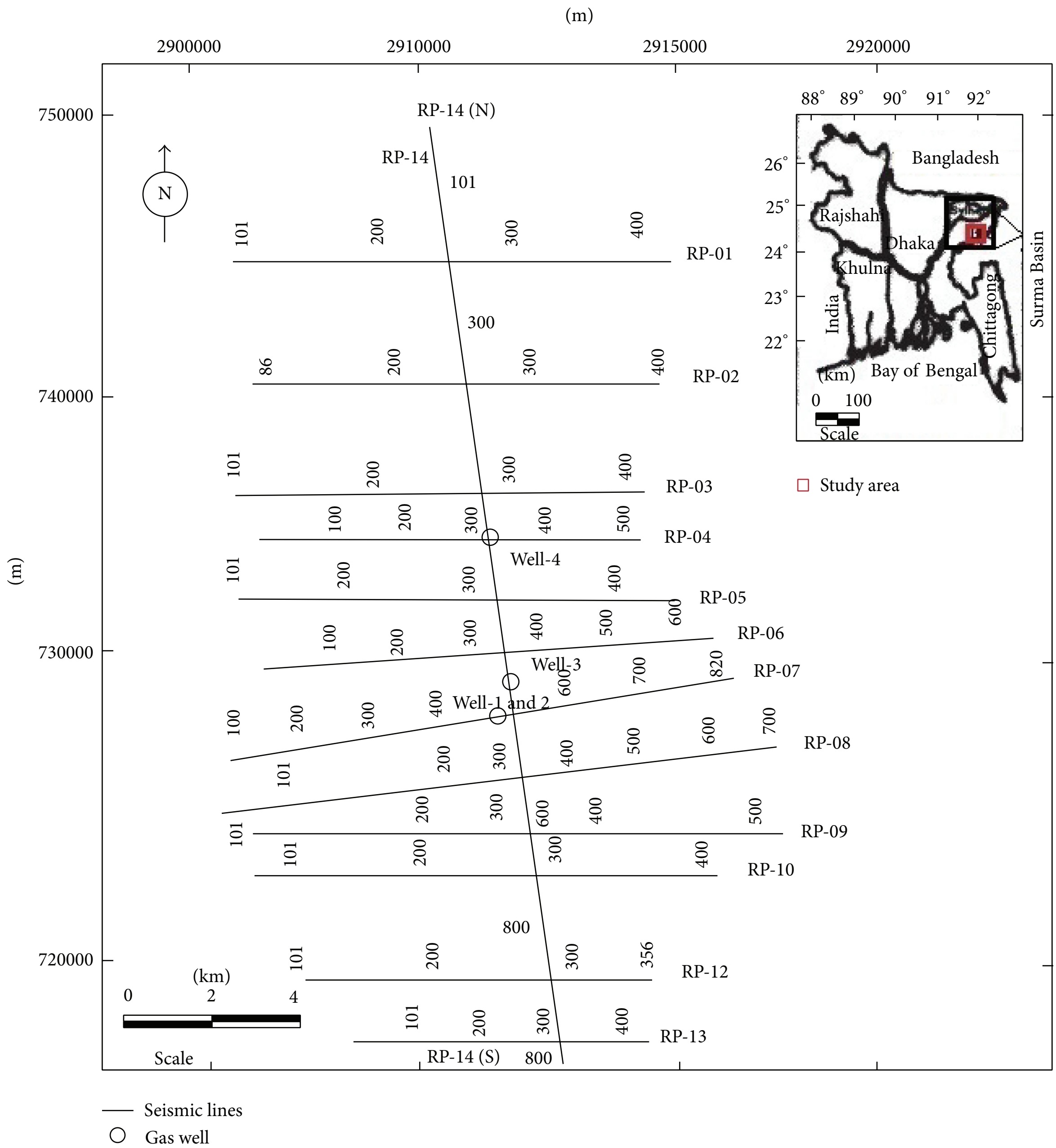

Figure 1: Location of the study and shot point map showing the orientation of 13 2D seismic lines (after modification from [14]).

Basin might have been formed at the late orogenic stage due to subsidence along the Dauki Fault system and Plio-pleistocene uplift of the Shillong Massif [17]. The tectonics of the basin are considered to be Neogene to Recent with severe period of crustal disturbance. The Rashidpur structure is situated in the southern part of the Surma Basin [14]. As an asymmetrical anticline, the eastern flanks of the structure are steeper (20°–25°) than the western flanks [18]. N-S trending Rashidpur structure is at the surface, a narrow anticline about 40.25 km long and 4.83 km broad [17]. The Lower to Middle Miocene Surma Group was consisting of the underlying Bhuban Formation and the overlying Boka Bil Formation were deposited during repeated transgression and regression phases of marine environment [19]. Table 1 represents the stratigraphic succession with spatial position in the reflecting horizons on the seismic section of the Rashidpur structure.

3. Materials and Method

Seismic data of the study were obtained from the Bangladesh Petroleum Exploration and Production Company Ltd. (BAPEX), a subsidiary company of Bangladesh Oil, Gas and Mineral Corporation (Petrobangla). A total of 13 2D seismic lines of 24-fold coverage were employed for the study (Figure 1). Of these lines, one was strike line and the rest were dip lines. Two reflectors were selected, out of five reflecting

Table 1: Summarized stratigraphic succession with spatial reflectors position in the Rashidpur structure (after BOGMC [4]).

Age	Group	Formation	Lithologic description	Thickness approximate (m)	Reflectors
Plio-Pleistocene	Dupi Tila	Dupi Tila	Mainly consists of unconsolidated sandstones, gray in color, medium to fine-grained with few soft and soapy sticky, gray clay, and intercalation of silt	314	R1
	Tipam	Tipam Sandstone	Consists of gray, brown to pale gray coarse-grained sandstones with intercalation of shale	1030	R2
Early to middle Miocene	Surma	Upper Marine Shale	Claystone or dark gray shale	187 (?)	R3 (UGS)
		Boka Bil Formation	Sandstone, siltstone with alteration of shale	1100	
		Bhuban Formation	Composed mainly of sandstones, silty sandstones, and shales. The upper part of this formation consists essentially of sandstone, light gray, moderately consolidated very fine-grained with calcareous cement	470+	R4 R5 (LGS)

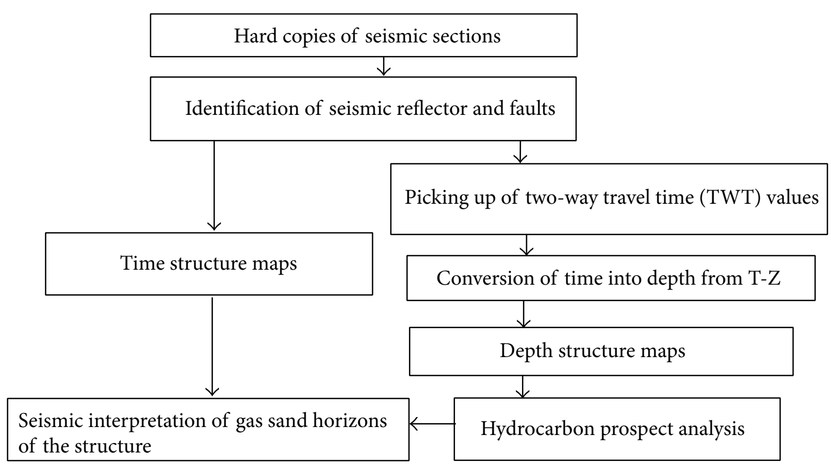

Figure 2: Flow chart for the seismic interpretation of gas sand horizons of the Rashidpur structure.

horizons and reflection times were picked up based on tracking the amplitude contrast boundary to prepare time structure maps. The T-Z curve was used for conversion to time (TWT) into depth to prepare depth structure maps. Computation of seismic structural time and depth maps were carried out by Surfer (version 8.0) software. Hydrocarbon prospects were analyzed with the help of amplitude anomaly, reflection coefficient (RC), and velocity analysis of the structure. The reflection coefficients were used to examine positive and negative responses. Any displacement of reflecting horizons due to fault was taken into consideration while picking the horizons and was plotted on the shot point map. After picking up these horizons, the two-way travel time (TWT) for respective reflecting horizons were posted in the shot point map considering certain interval of shot points (SP) and common depth point (CDP). The basic principle of seismic structural interpretation was described by [20, 21]. The entire processes are summarized in the flow chart shown in Figure 2.

4. Results and Discussion

Time (TWT) and depth structural maps were prepared on top of the two selected reflecting horizons. Depths were converted into seismic sections which are convenient for structural interpretation rather than time sections and velocity sections.

4.1. Seismic Structural Analysis. On the basis of reflection continuity, amplitude anomalies, velocity changes, polarity changes, and frequency of the seismic sections, correlation with the wells of the Rashidpur structure were identified five reflectors. Out of five reflectors, two selected gas sand reflectors were selected and correlated with the well information, that is, top of the Upper Gas Sand (R3) and top of the Lower Gas Sand (R5) reflectors. Data quality of the seismic lines RP-01, RP-02, and RP-06 in the crestal part are fair to good but at about the middle part of the structure in the line RP-04 is very good quality whereas the crestal part of the structure starts to low quality and continue in the lines RP-06 to RP-09 data are very poor quality. Again, in the lines RP-10 to RP-13 data started to improve the quality. Figure 3 reveals that geologic interpretation of seismic sequences in terms of TWT (ms) along the seismic section of the lines RP-01, RP-07, and RP-13 in the Rashidpur structure. Reflectors are more or less continuous, close-spaced, and parallel in character. The strike line RP-14 and the dip line RP-07 pass through the wells RP #2, 3, and 4, respectively (Figure 1). The line RP-07 is almost perpendicular to the fault which is located to the eastern flank of the structure (Figure 3). The seismic section of the lines RP-02, RP-04, and RP-07 passes across the structure and line RP-14 along the axis indicate quite a number of reflection anomalies. The dip line RP-04 was identified in the mid part of the structure along W-E direction in the well RP #4. The line RP-04 on the seismic section at SP 340 represent the boundary between R5 and R4 reflecting horizons at TWT 1900 ms and between R4 and R3 at TWT 1800 ms and between R3 and R2 were identified at TWT 1600 ms and between R2 and R1 at TWT 1200 ms, respectively (Figure 4). The strike line RP-14 was oriented almost along NNW-SSE direction on the real seismic section. It intersects all dip line of the Rashidpur structure and data quality of the strike line RP-14 over the crest is fair to poor (Figure 5).

4.1.1. Upper Gas Sand (R3) Reflector. The Upper Gas Sand (R3) reflector is located at 1200 ms (TWT). This reflector lies between the time range of 1300 ms and 2400 ms TWT which is correlated to the top of the Upper Gas Sand (R3) within the Boka Bil Formation of Early Miocene age. It is identified just above the Bhuban Formation and below the Upper Marine Shale Formation (Table 1). The structure is closed to a depth of 1400 m which is about 1250 ms TWT (Figures 6(a), 6(b), 7(a), and 7(b)). Thrust fault is identified on this seismic horizon (Figure 3(b)). Time contour map of the Upper Gas Sand (R3) reflector lies just below the Upper Marine Shale (R2) reflector. This is also observed from the geological cross-section of the time contour map (Figure 3). The structure at the top of the gas sand reflector (R3) is elongated N-S with the axis swinging slightly to the east on the northern plunge and is about 450 ms below the Upper Marine Shale (R2) reflector. The eastern flank is thrust faulted that extends from the line RP-02 in the north to the line RP-12 in the south. This reflector has identified at 1210 ms TWT in the western flank and the same reflector has identified at 1660 ms TWT at the eastern flank on the line RP-07. Fault displacement is about 450 ms TWT (Figure 3(b) and Table 2). Fairly well-developed reflection events have identified and correlated within the fault zone in the lines RP-02, RP-04, and RP-05. However, the depth and time values gradually increase almost uniformly in all directions from the crestal part of gas horizons of the structure.

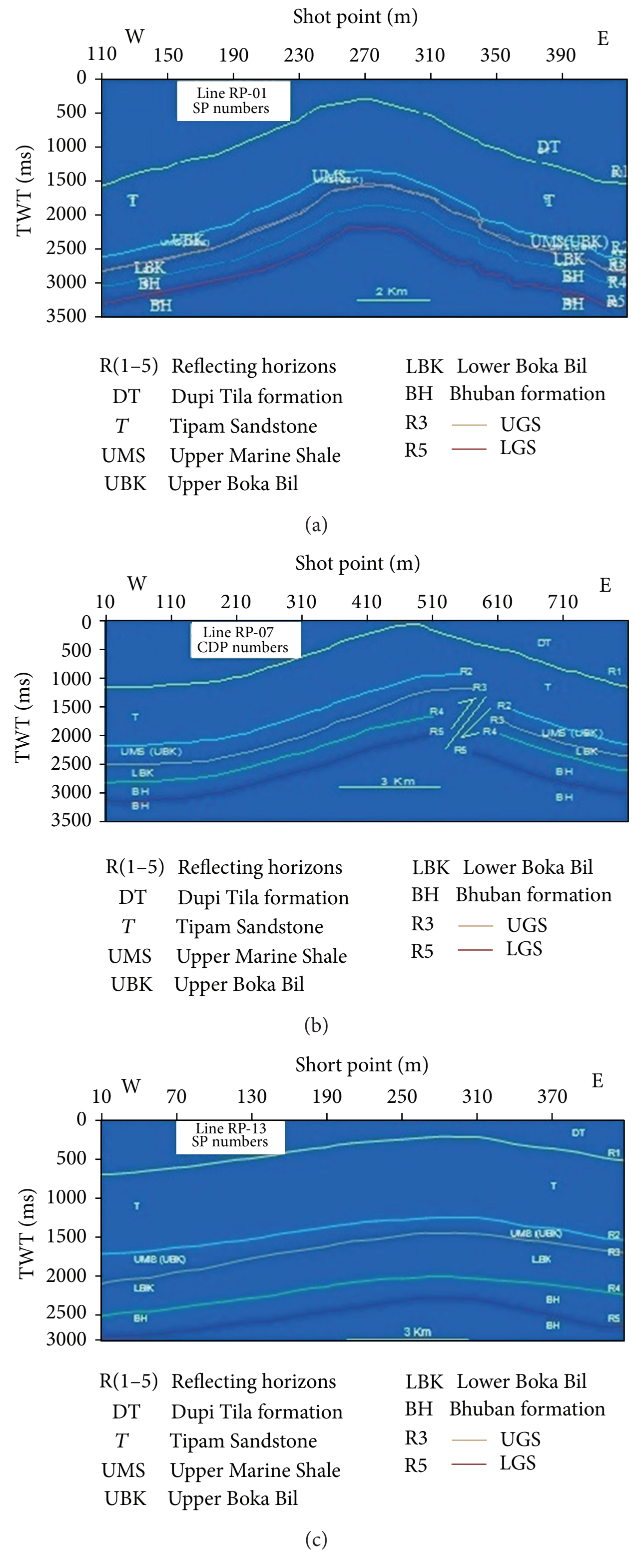

Figure 3: Geologic interpretation of seismic sequences along the seismic sections in the structure, (a) Seismic line RP-01, (b) Seismic line RP-07, and (c) Seismic line RP-13.

4.1.2. Lower Gas Sand (R5) Reflector. The Lower Gas Sand (R5) reflector is located at 1900 ms (TWT) at the crest on the seismic sections. This deepest reflector lies between

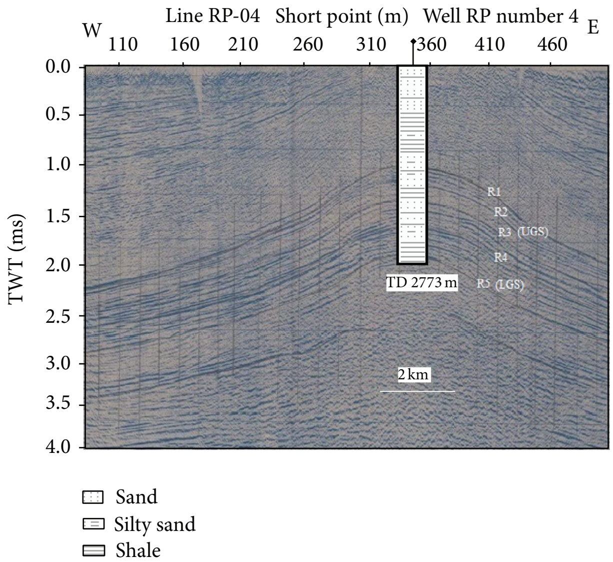

Figure 4: Geologic correlation between seismic sections at line RP-04 in the well RP #4 of Rashidpur structure.

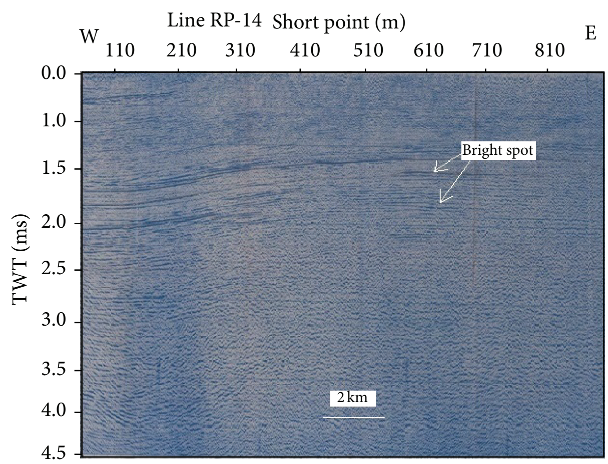

Figure 5: Seismic section along the line RP-14 showing bright spot in the structure.

the time range of 1900 ms and 3000 ms TWT which is correlated to the top of the Lower Gas Sand (LGS) within the Bhuban Formation of Mid-Lower Miocene age (Table 1). The structure is closed to a 1900 ms TWT which is about the depth of 2400 m (Figures 8(a), 8(b), 9(a), and 9(b)). The maximum magnitude of fault is approximately 310 ms which is identified on the seismic section RP-07 (Figure 3(b) and Table 2). The structure at the top of the Lower Gas Sand (R5) reflector is elongated N-S with the axis swinging slightly to the east on the northern plunge and is about 700 ms below the Upper Gas Sand reflector (R3). Fairly well developed reflection events have been identified within the fault zone in the lines RP-02 and RP-07 (Figure 11). It lies about 150 ms below the reflector (R4). The Lower Gas Sand (R5) reflector is not as strong as Upper Marine Shale (R2) reflector as for the Lower Gas Sand (R5) reflector, considerable problem was experienced in correlating the gas sand horizons. This reflector is of very poor quality in the crestal part of the structure. Presence of numerous faults creates the problems for gas sand horizons. However, the central long zone of these maps has the low depth as well as low time value indicate the crestal part of the horizon of the structure. The structure of the top of the Lower Gas Sand (R5) reflector is about similar in nature to that of the top of the Upper Gas Sand (R3) reflector. Moreover, the major fault is of narrower width but there are numerous other small faults running N-S trend on the eastern flank of the structure.

Table 2: Show identified fault displacement magnitude of gas sand horizons in the structure.

Gas sand horizons/reflectors	Fault displacement	
	TWT (ms)	Depth (m)
UGS (R3)	450	600
LGS (R5)	310	430

4.2. Hydrocarbon Prospect Analysis. The presence of gas in a reservoir often produces a detectable suite of response in the seismic sections from the commercial point of view. In the previous work, it is not clearly described the number of seismic parameters which is used to identify the gas sand horizons so far. In the present research, attention has been drawn to consider all the geologic and geophysical evidences concerning hydrocarbon prospects of gas sand horizons in the Rashidpur structure.

4.2.1. Velocity Analysis. The Rashidpur structure shows an almost continuous change in velocity with depth because of its thin layering. The Upper Gas Sand (R3) reflector has the average velocity of 3408 m/s, which is 45% greater than that of the earlier of the reflector (R2) and the velocity of Lower Gas Sand (R5) reflector has an average velocity of 4320 m/s, which is 26.8% higher than that of the Upper Gas Sand (R5) reflector (Table 3). The lithological change increases in compaction and decreases in porosity with depth are the main reasons behind the velocity fluctuations which increase with depth of the structure. Velocity gradually increases with depth except two gas sand horizons where velocity suddenly dropped. Composite well log responses confirm that the velocity dropped and shown hydrocarbon prospect in the two gas sand horizons of the Rashidpur structure (Figure 10). Islam et al. [15] also found similar result in the well RP #04 of the Surma Basin. The depth range of 1380 m to 1462 m having thickness of 82 m, velocity dropped from 2562 m/s to 2177 m/s, indicates the Upper Gas Sand (R3) reflector. This is because this zone has the higher amount of porosity and gaseous hydrocarbon fills the pore space as a result velocity decreases. Lower Gas Sand (R5) shows different velocities; there is no gradual increase or decrease pattern of velocity change in this part. The depth range of 2706 m to 2761 m having thickness of 55 m, velocity dropped from 4320 m/s to 3413 m/s, indicates Lower Gas Sand (R5) reflector (Table 4). These two gas sand horizons have average ranges of porosity from 18% to 27% [22]. This porosity is filled with gaseous hydrocarbon [23].

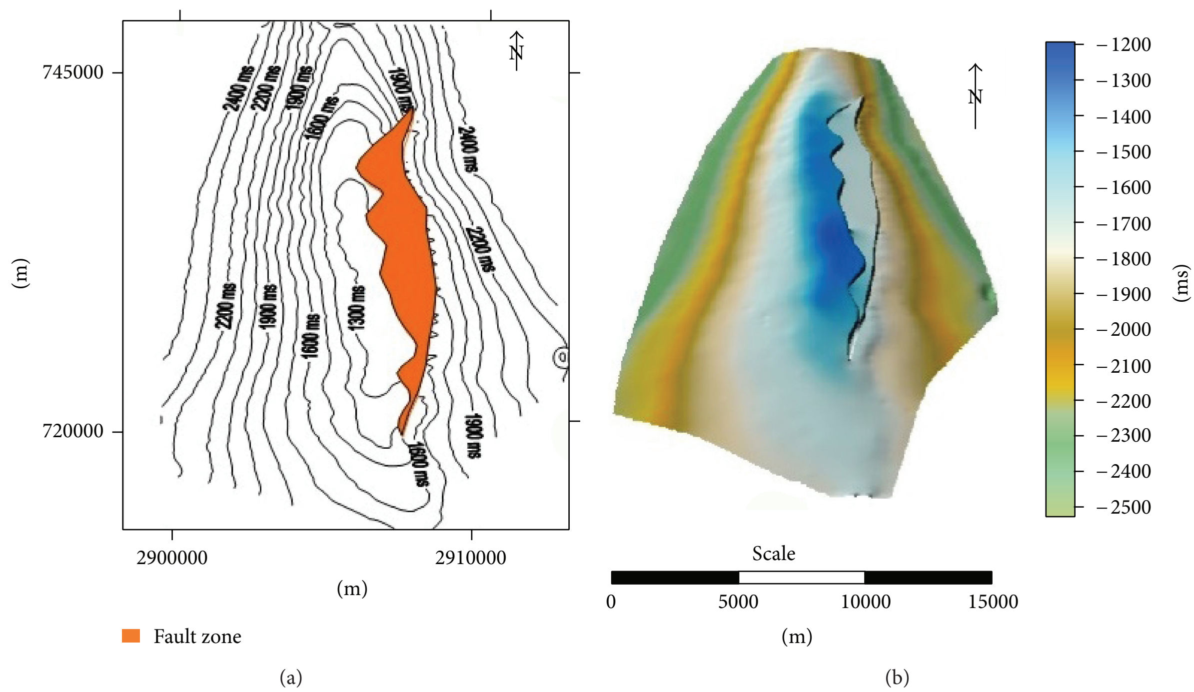

Figure 6: (a) Time structure map on the top of the Upper Gas Sand (R3), Contour interval 100 ms. (b) Subsurface relief map on the top of the Upper Gas Sand (R3).

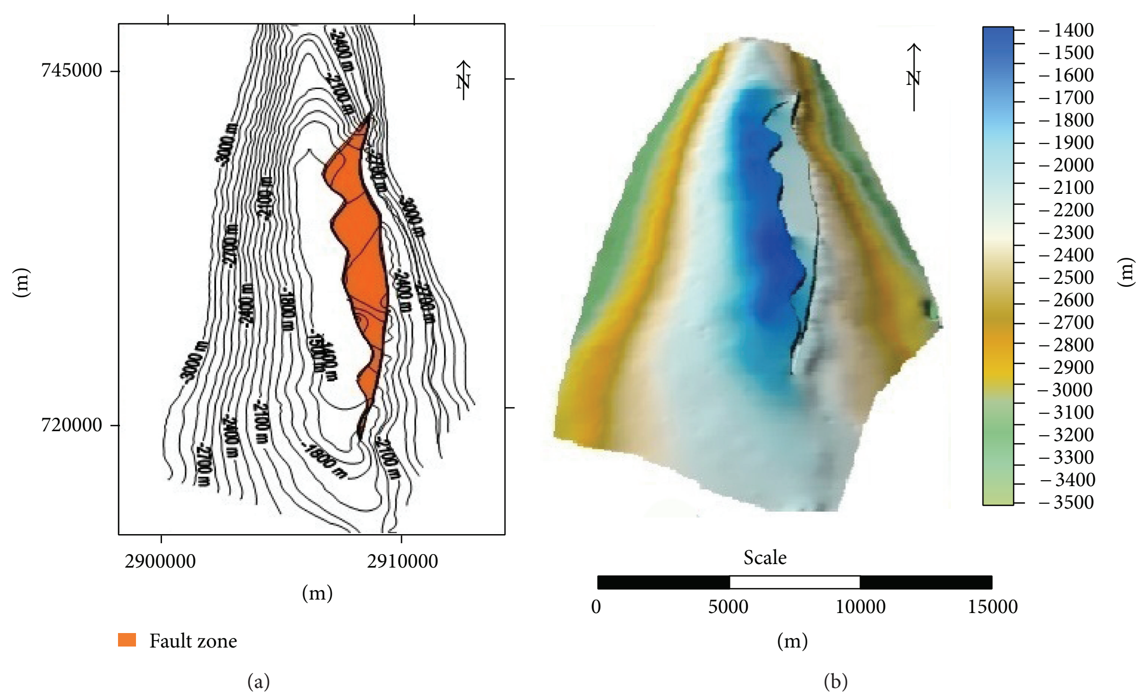

Figure 7: (a) Depth structure map on the top of the Upper Gas Sand (R3), Contour interval 100 m. (b) Subsurface relief map on the top of the Upper Gas Sand (R3).

4.2.2. Reflection Coefficient (RC) and Amplitude Response Analysis. The reflection coefficient and the reflection amplitude depend on the contrast in acoustic impedance across the reflecting interface which changes between the cap rock and gas bearing reservoir rock affecting the amplitude and polarity of the top reservoir reflection. The reflection coefficients are positive at the base and negative at the top of the Upper Gas Sand (R3) reflector. Reflection coefficient

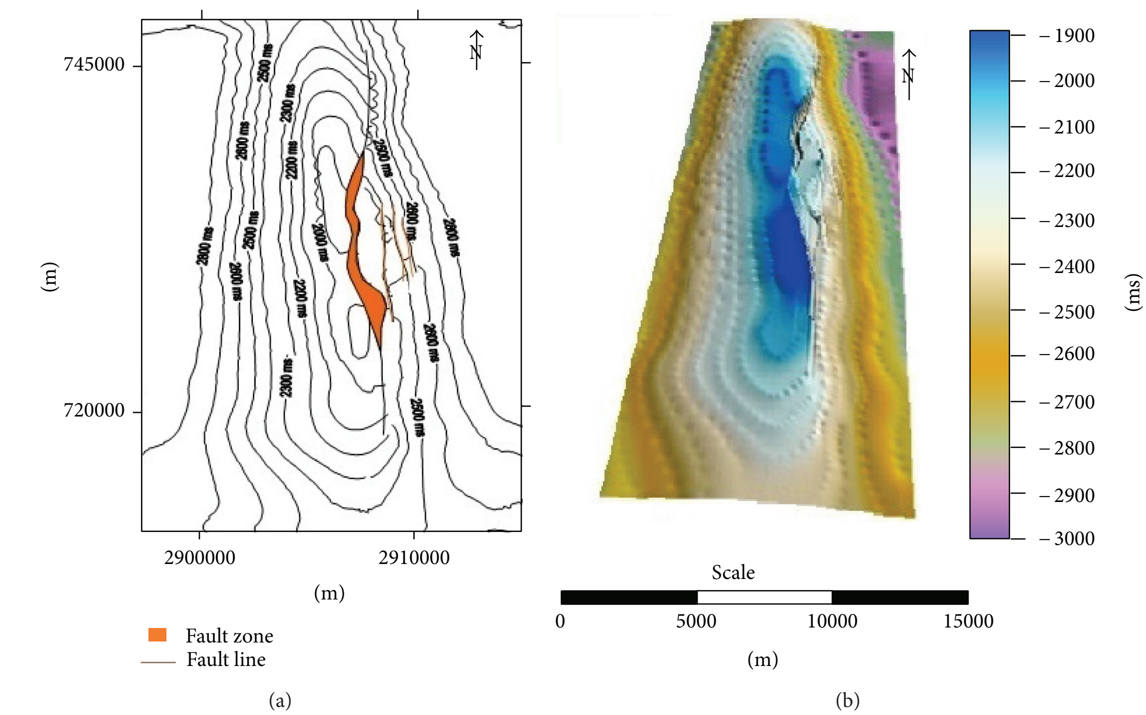

FIGURE 8: (a) Time structure map on the top of the Lower Gas Sand (R5), Contour interval 100 m. (b) Subsurface relief map on the top of the Lower Gas Sand (R5).

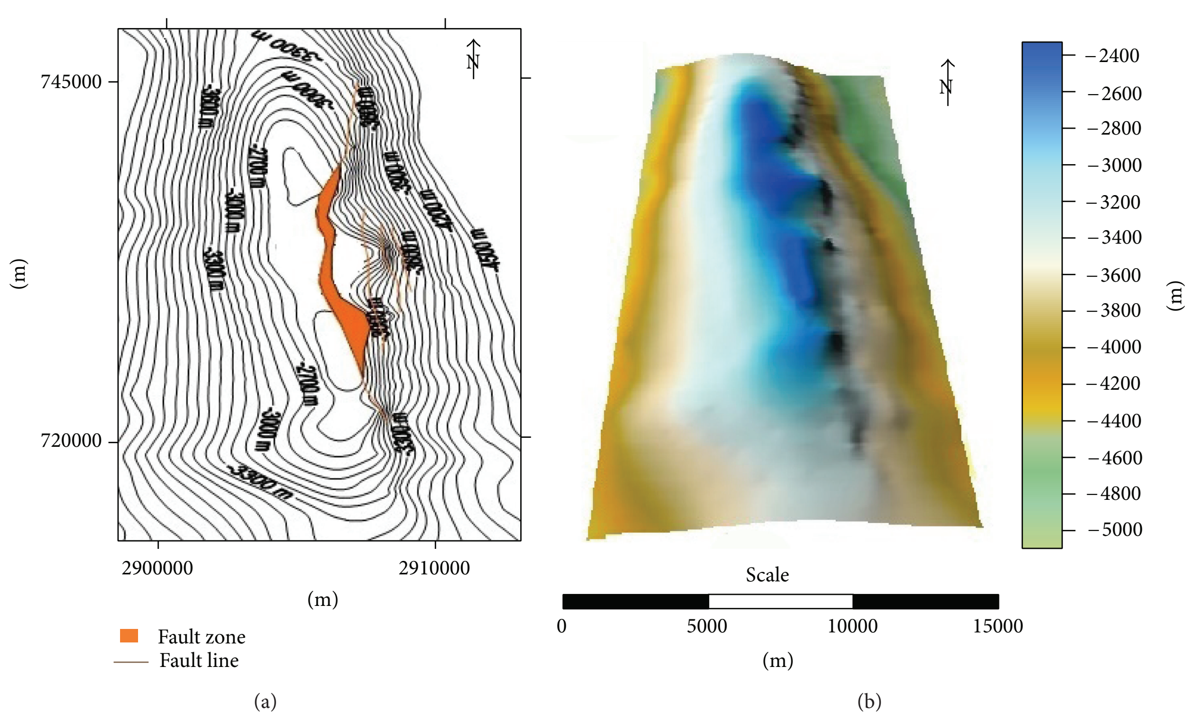

FIGURE 9: (a) Depth structure map on the top of the Lower Gas Sand (R5), Contour interval 100 ms. (b) Subsurface relief map on the top of the Lower Gas Sand (R5).

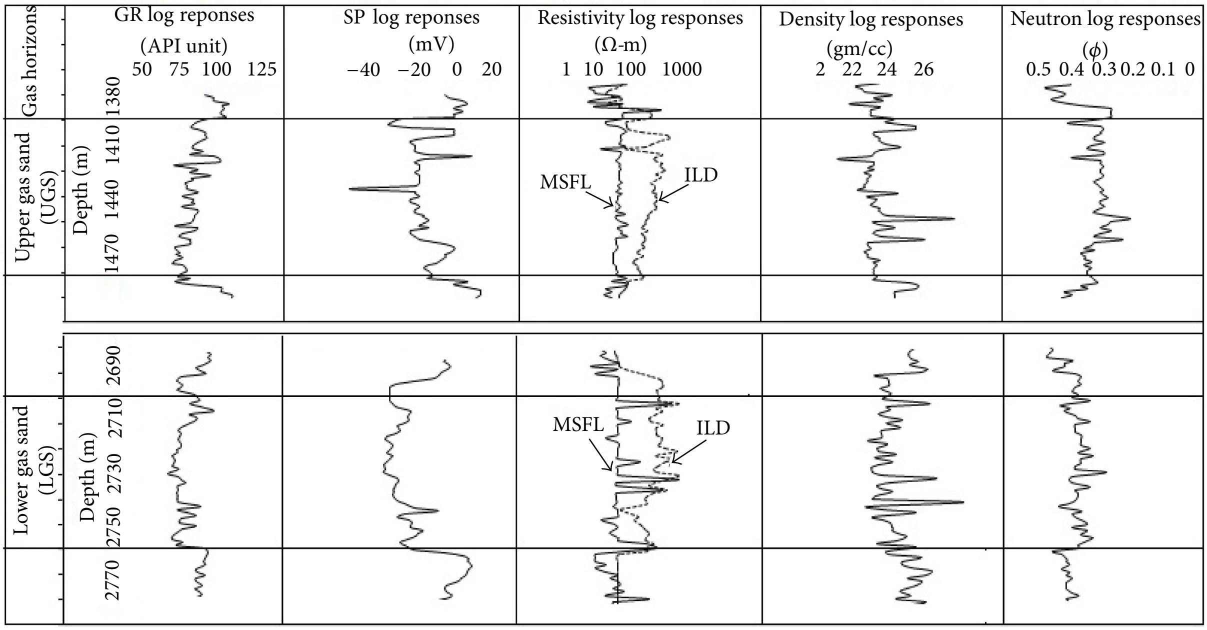

Figure 10: Composite well log responses in the gas sand horizons of the well RP #4 (after Islam et al. [15]).

Table 3: Represent average velocity changes with depth of gas sand horizons in the Rashidpur structure.

Gas sand horizons/reflectors	Depth (m)	Thickness (m)	Ave. Velocity (m/s)	TWT (sec)	Remarks
UGS (R3)	1380–1462	82	3408	1.042–1.450	Max. velocity 4012 m/s Min. velocity 2178 m/s
LGS (R5)	2706–2761	55	4320	1.450–2.918	Max. velocity 5542 m/s Min. velocity 3387 m/s

Table 4: Show subsurface seismic interfaces of gas sand horizons in the Rashidpur structure.

Depth range (m)	Thickness (m)	Velocity (m/sec)	Density (kg/m^3)	RC	TC	Reflectors
1332–1380	48	2562	2206	−0.057	1.057	R3 (UGS)
1380–1462	82	2177	2156	0.127	0.873	
2630–2706	76	4320	2414	−0.085	1.085	R5 (LGS)
2706–2761	55	3413	2332	0.094	0.906	

of the Upper Gas Sand (R3) is 0.127 at the base and −0.057 at the top in depth range from 1380 m to 1462 m. Reflection coefficient of Lower Gas Sand (R5) reflector is 0.094 at the base and −0.085 at the top in the depth range from 2706 m to 2761 m (Table 4). The result infers that gas sand horizons are mainly fair to weak type in the structure. The results of RC and TC values are similar to the event amplitudes for the Rashidpur structure [13]. Seismic amplitude anomaly is important to interpret such anomalies with care and to take into account other possible hydrocarbon indicators such as phase change of reflection and pull-down of events beneath the prospective zone, as well as judging the geological feasibility of the anomaly being associated with a gas pool. The amplitude anomaly has identified in the seismic section on the line RP-02 between SP 190 and 230 at TWT 1720 ms indicates the presence of hydrocarbon (Figure 11(a)). Low acoustic impedance in gas bearing sand as well as higher reflection coefficients indicates the presence of gas in the reservoir [24]. Top of the UGS and the LGS reflectors give higher reflection amplitude accompanied by corresponding polarity changes. A polarity reversal of the top of the gas sand horizon is a common feature of bright spot (Figure 5). A flat spot is visible in the southern part of the structure on the lines RP-07 at the intersection with line RP-14 at CDP 661 (Figure 11(b)). Flat spots are perhaps the best indications for gas and mark the gas/water contact. Flat spots always have positive RC appearing as a trough on the seismic sections with normal polarity or a peak on reverse polarity sections. Reflection amplitude analysis is important for hydrocarbon prospect analysis, which is directly controlled by the velocity

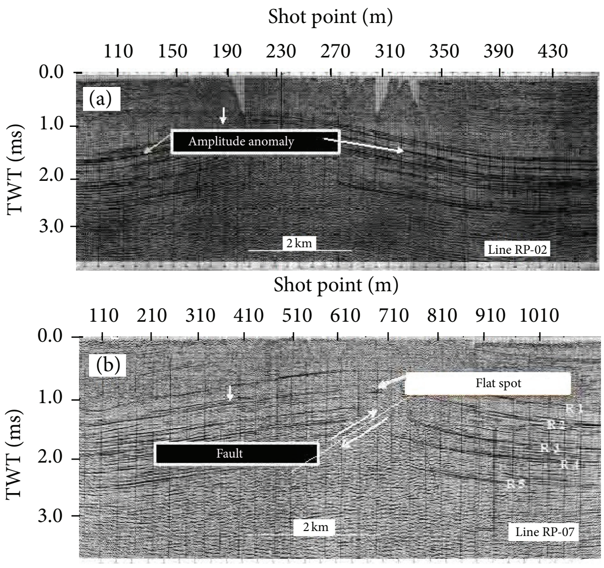

Figure 11: (a) Representation of amplitude anomaly along seismic line RP-02 of the Rashidpur structure. (b) shows presence of fault and flat spot along seismic line RP-07 of the Rashidpur structure.

and density contrast of the subsurface materials. The density contrast generally depends upon the degree of difference of the lithology. Such amplitude anomalies show negative RC in porous gaseous sand [25]. In the study, identified thrust fault could be compartmentalizing the gas reservoir (Table 2). The result supports the finding of Habib and Islam [26] who carried out electrofacies and core sample data analysis in the well RP #4 of the Rashidpur structure, Bengal Basin.

5. Conclusion

The study attempt was to evaluate the gas sand horizons of the Rashidpur structure, Surma Basin, Bangladesh. The Upper and Lower Gas Sand reflector (R3 and R5) were identified in the top of Boka Bil and the Bhuban Formations of Early to Middle Miocene age in the Rashidpur structure. Both reflectors cover 45 km^2 and 49 km^2, respectively, in the structure. N-S trending thrust fault was identified which is almost parallel to the strike line having magnitude of displacement ranges from 390 m to 600 m at the middle part of the structure. The width of the fault zone is larger at the central part of the structure that becomes narrower in both directions. The velocity gradually increases with depth except for two gas sand horizons where velocity suddenly dropped. The reflection coefficients are positive at the base and negative at the top of the both gas sand horizons. High amplitude anomaly and bright spots were identified on the top of the both gas sand horizons signify as an indicator of hydrocarbon prospect. Structural maps show that the asymmetrical anticline fold and thrust fault were formed possibly due to compression, which can be correlated with the different phases of the Himalayan Orogeny. Reflections anomaly, velocity changes, and reflection coefficients suggest that two gas sand horizons existed in both side of fault of the structure. The result reveals that the structure is potential for hydrocarbon prospect. The study recommend that if 3D seismic study will be conducted in the structure in order to get more clear picture of the subsurface geometry and to delineate microlevel fault of the structure.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of the paper.

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References

[1] M. E. Badley, *Practical Seismic Interpretation*, D. Reidel Publishing Company, Dordrecht, The Netherlands, 1985.

[2] M. I. Bakhtine, "Major tectonic features in Pakistan, part II: Eastern Province," *Science and Industry*, vol. 4, no. 2, pp. 89–100, 1966.

[3] BAPEX, "Sedimentology petrography," in *Geochemistry and Biostratigraphy of Rashidpur Structure*, BAPEX, Surma Basin, Bangladesh, 1989.

[4] BOGMC, "Rashidpur well no. 3 and 4," Well Completion Report, BOGMC, Dhaka, Bangladesh, 1989.

[5] I. Cohen and R. R. Coifman, "Local discontinuity measures for 3-D seismic data," *Geophysics*, vol. 67, no. 6, pp. 1933–1945, 2002.

[6] F. Deeba, D. Hossain, and A. Q. M. R. Rahman, "Geology and hydrocarbon potentiality of BeaniBazar structure in Surma basin Bangladesh using geophysical and well data," *Bangladesh Geosciences Journal*, vol. 7, 2001.

[7] F. Deeba and D. Hossain, "Subsurface mapping of the Beani Bazar anticlinal structure of Surma Basin, Bangladesh," *Journal of the Geological Society of India*, vol. 67, no. 2, pp. 201–210, 2006.

[8] M. B. Dobrin and C. H. Savit, *Introduction to Geophysical prospecting*, McGraw-Hill, Singapore, 4th edition, 1988.

[9] D. K. Guha, "Tectonic framework and oil and gas prospects of Bangladesh," in *Proceedings of the 4th Annual Conference Issue*, pp. 65–74, Bangladesh Geological Society, Dhaka, Bangladesh, 1978.

[10] J. G. Hagedron, "A process of seismic reflection interpretation," *Geophysical Prospecting*, vol. 2, pp. 85–127, 1954.

[11] K. Hiller and M. Elahi, "Structural development and hydrocarbon entrapment in the Surma Basin, Bangladesh (Northwest Indo-Burman Fold Belt)," in *Proceedings of the 5th Offshore South East Asia Conference*, pp. 650–663, February 1984.

[12] A. Hossain, "Evaluation of upper gas sand (UGS) in Habiganj area and the seismic response from its base indicating an alternate interpretation of gas water contact (GWC)," *Bangladesh Journal of Geology*, vol. 11, pp. 41–56, 1992.

[13] D. Hossain, "On the application of common-depth-point shooting in the Surma basin, Bangladesh: a case study of the Rashidpur structure," *Journal of the Geological Society of India*, vol. 55, no. 2, pp. 149–156, 2000.

[14] A. Sohel, S. Kabir, and D. Hossain, "Geophysical interpretation of the rashidpur structure, surma basin, Bangladesh," *Journal of the Geological Society of India*, vol. 74, no. 1, pp. 39–48, 2009.

[15] A. R. M. T. Islam, M. A. Habib, M. T. Islam, and M. R. Mita, "Interpretation of wireline log data for reservoir characterization of the Rashidpur Gas Field, Surma Basin, Bangladesh," *IOSR Journal of Applied Geology and Geophysics*, vol. 1, no. 4, pp. 47–54, 2013.

[16] K. A. Islam and D. Hossain, "Interpretation of seismic data of the Kailas Tila Structure in the Surma Basin, Bangladesh," *Journal of the Geological Society of India*, vol. 60, no. 3, pp. 271–281, 2002.

[17] S. Y. Johnson and A. M. N. Alam, "Sedimentation and tectonics of the Sylhet trough, Bangladesh," *Bulletin of the Geological Society of America*, vol. 103, no. 11, pp. 1513–1522, 1991.

[18] M. A. M. Khan and M. Hussain, "Geology of Bangladesh gas fields," in *Proceedings of the Offshore South East Asia Conference Issue*, SEAPEX Session, February 1980.

[19] M. A. M. Khan, M. Islam, and M. Ahmed, "Geology and hydrocarbon prospects of the Surma Basin, Bangladesh," in *Proceedings of the 7th Offshore South East Asia Conference*, pp. 364–367, Sita Pahar, Bangladesh, 1988.

[20] J. Leitz and J. Kabir, "New aspects on the oil and gas potential of the Bengal Basin, Bangladesh," in *Proceedings of the Offshore South Asia Conference*, p. 3, Singapore, 1982.

[21] M. C. Quillin, M. Bacon, and W. Barclay, *An Introduction to Seismic Interpretation*, Gulf Publishing Company, Houston, Tex, USA, 1979.

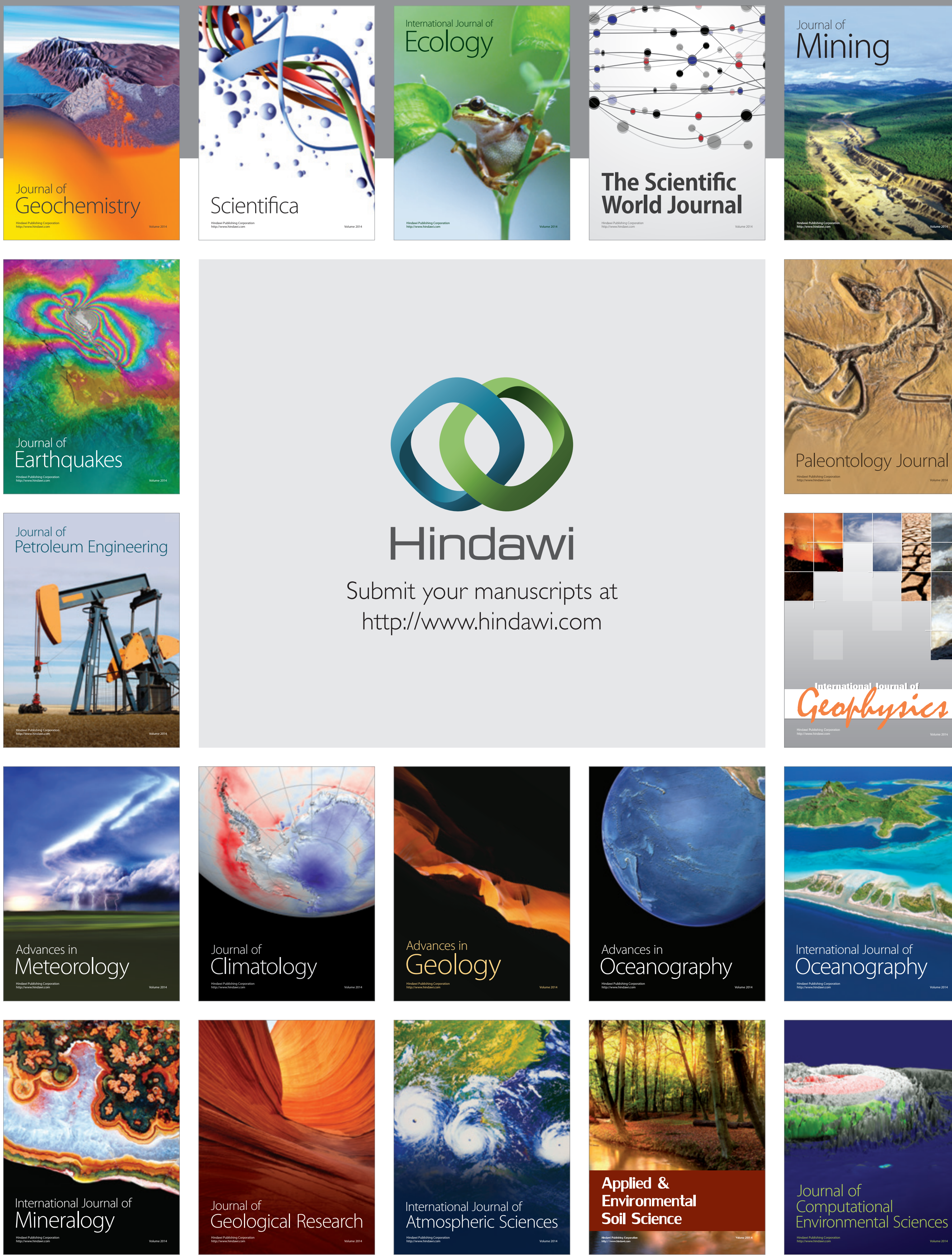
[22] K. U. Reimann, *Geology of Bangladesh*, Gerbuder Borntraeger, Berlin, Germany, 1993.

[23] A. H. M. Shamsuddin and S. K. M. Abdullah, "Geological evolution of the Bengal Basin and its implication in hydrocarbon exploration in Bangladesh," *Indian Journal of Geology*, vol. 69, no. 2, pp. 93–121, 1997.

[24] R. E. Sheriff, "Basic petrophysics and geophysics," in *Reservoir Geophysics no. 7*, Society of Exploration Geophysics, Tulsa, Okla, USA, 1992.

[25] R. E. Sheriff and L. P. Geldart, *Exploration Seismology*, Cambridge University Press, Cambridge, UK, 1995.

[26] A. Habib and A. R. M. T. Islam, "Paleoenvironmental reconstruction of miocene surma succession in the well rashidpur # 04 of Bengal Basin using log facies interpretation," *Iranian Journal of Earth Sciences*, vol. 6, no. 1, pp. 12–23, 2014.



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