2. Holtkamp, D. E., Gresling, J. G., Root, C. A. and Lerner, L. J., *Proc. Soc. Exp. Biol. Med.*, 1960, **105**, 197.
3. Segal, S. J. and Nelson, W. O., *Anat. Rec.*, 1961, **139**, 273.
4. Van Maanen, E. F., Greslin, J. G., Holtkump, D. E. and King, W. M., *Fed. Proc.*, 1961, **20**, 419.
5. Nelson, W. O. and Patanelli, D. J., *Fed. Proc.*, 1962, **21**, 437.
6. Greenblatt, R. B., Barfield, W. E., Jungck, E. C. and Ray, A. W., *Am. J. Med. Assoc.*, 1961, **178**, 101–104.
7. Roy, Somnath, Meeting, Am. Soc. Study of Sterility, Chicago, March, 1962.
8. Roy, Somnath, Greenblatt, R. B., Mahesh, V. B. and Jungck, E. C., *Fertil. Steril.*, 1963, **14**, 575–595.
9. Roy, Somnath, Mahesh, V. B. and Greenblatt, R. B., *Acta Endocrinol. Kbh.*, 1964, **47**, 645–656.
10. Roy, Somnath, Greenblatt, R. B. and Mahesh, V. B., *Acta Endocrinol.*, 1964, **47**, 657–668.
11. Roy, Somnath, Greenblatt, R. B and Mahesh, V. B., *Acta Endocrinol.*, 1964, **47**, 669–675.
12. Docke, F., *J. Reprod. Fertil.*, 1969, **18**, 135–137.
13. Donavan, B. T., *J. Endocrinol.*, 1971, **51**, 387–391.
14. Kaul, D. K. and Ramaswami, L. S., *Gen. Comp. Endocrinol.*, 1968, **10**, 355–363.
15. Glasier, A. F. *et al.*, *Human Reprod.*, 1989, **4**, 252–256.
16. Peterson, N. T., Midgley, A. R. Jr. and Jaffe, R. B., *J. Clin. Endocrinol.*, 1968, **22**, 1473–1478.
17. Kobayashi, T. *et al.*, Proc. 5th Word Congr., Fertil. Steril, Stockholm, 1966, p. 160.
18. Boyar, R. M., *Endocrinology*, 1970, **86**, 629–633.
19. Coppola, J. A. and Perrine, J. W., *J. Reprod. Fertil.*, 1965, **13**, 373–374.
20. Watnik, A. S. and Neri, R. O., *Acta Endocrinol.*, 1968, **59**, 611–621.
21. Schwantje, R. and Taubert, H. D., *J. Reprod.*, 1971, **25**, 1–9.
22. Igarashi, M., Ibuki, Y., Kubo, H., Kamioka, J., Yokota, N., Ebara, Y. and Matsumoto, S., *Am. J. Obstet. Gynecol.*, 1967, **97**, 120–123.
23. Clerk, J. H. and Markaverich, B. M., *Pharmacol. Ther.*, 1982, **15**, 467–519.
24. Kumar, Arun and Pakrasi, P. L., *J. Biosci.*, 1995, **20**, 665–673.
25. Adashi, E. Y., *Sem. Reprod. Endocrinol.*, 1986, **4**, 255.
26. De Moura, M. D., Ferriani, R. A. and de sa, M. F. S., *Fertil. Steril.*, 1992, **58**, 504.
27. Smith, O. W., *Am. J. Obstet. Gynecol.*, 1966, **9**, 440.
28. Engels, J. A., Friedlander, R. L. and Eik-Nes, K. B., *Metabolism*, 1968, **17**, 189.
29. Hagerman, D. D., Smith, O. W. and Day, C. F., *Acta Endocrinol. Kbh.*, 1966, **51**, 591.
30. Harman, S. M., Louvel, J. P. and Ross, G. T., *Endocrinology*, 1975, **96**, 1119–1122.

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Divergent structure and composition of the two colliding protocontinents as evidenced from seismic studies

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Coincident reflection/refraction studies across Central Indian Suture (CIS) have yielded crustal structure. The refraction input was confined to a part of the profile, resulting in non-availability of velocity–depth information, an essential component for understanding the composition and rheology of different crustal columns. Using a well-known algorithm of Megallaa, deep reflection data have been utilized in arriving at crustal interval velocity information for the region between Katangi and Kalimati across CIS. It is evident from the present results that the two crustal segments on either side of CIS that were imaged earlier by deep reflection profiling (TWT cross-sections), have significantly different compositions (from velocity information). It is noticed that the north-western crustal segment, belonging to Bundelkhand protocontinent has denser lower crust with a velocity of about 7.0 km/s and relatively normal P_n velocity of 8.1 km/s (for the uppermost mantle velocity). The south-eastern crustal segment belonging to the Deccan protocontinent, while having a similar velocity structure for upper and mid crustal columns (thereby probably similar composition) has a relatively less denser lower crust (with a velocity of 6.7 km/s). It is also interesting to note that the P_n velocity in this segment is only of the order of 7.8–7.9 km/s. Tectonic significance of the results is discussed.

COINCIDENT deep reflection/refraction studies along the 150 km long Mungwani–Katangi–Kalimati profile (Figure 1) have yielded useful information regarding the reflectivity character of the two crustal blocks that are present on either side of the Central Indian Suture (CIS)[1,2]. The limited refraction control with data from two shotpoints, namely SP0 and SP100 has yielded velocity–depth information for the region between Seoni and Katangi. Velocity information in the region between Katangi and Kalimati could not be obtained for want of refraction data. Because of this information gap, even though the divergent reflection fabric on either side of the CIS indicates presence of different crustal segments on either side of the CIS, a meaningful knowledge of the probable composition of different crustal layers (upper, middle and lower) could not be obtained. Since the velocity information is an important input and as the studies across a part of Aravalli

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7. Roy, Somnath, Meeting, Am. Soc. Study of Sterility, Chicago, March, 1962.
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16. Peterson, N. T., Midgley, A. R. Jr. and Jaffe, R. B., *J. Clin. Endocrinol.*, 1968, **22**, 1473–1478.
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fold belt[3] using the reflection data have yielded useful velocity information, an attempt has been made to derive crustal interval velocity information for the region between Katangi and Kalimati utilizing the algorithm developed by Megallaa[4]. Details of the method, processing exercise and interpretation of the derived results are detailed below.

The derivation of the interval velocity is done in two ways, either by using rms velocities or by using average velocities[5]. Here, we have made use of rms velocities. For non-dipping interfaces, rms velocity is same as the velocity obtained by the analysis, i.e. stacking velocity. But, in case of dipping horizons, the values of stacking velocities obtained by the analysis are quite high. However, these values, when multiplied by the cosines of the angle of dip, give a value close to the rms velocity at the centre of the seismic spread[6]. In the present case, we have used the theory of Everett[7] and algorithm of Megallaa[4] comprising three steps namely (1) obtaining Maximum Coherency Stack (MCS) velocities from the Common Depth Point (CDP) reflection data; (2) deriving rms velocities from stacking velocities; and (3) finding interval velocities from rms velocities. CDP-derived velocities cannot be matched in accuracy and resolution with the velocities derived from direct-well measurements/refraction measurements. But in the absence of well/refraction results, the interval velocity is very useful. Precision requirements[5] for the general interpretation vary between modest (1–5%) to low (> 5%). The present exercise is carried out keeping the above aspects in view and the results obtained are within the precision requirements. Interval velocities at every 200th CDP (about 10 km) were obtained from the stacking velocities along Katangi–Kalimati segment, as explained above. Prominent reflectors under the specified CDPs (CDP 311, 511, 711, 911, 1111) were picked from the stacked section and submitted to a C program, which was written based on the algorithm of Megallaa[4]. This has yielded one set of dip-corrected interval velocity values for the reflectors under each specified CDP (Figure 2).

Deep reflection profiling (DRP) data have been acquired by two 60 channel DFS V stations deployed under Master/Slave mode, with a source–receiver geometry of 100 m. The data up to 20 s two-way time (TWT) have been processed and stacked sections generated[1]. From the stacked sections, for the present exercise, prominent and reasonably long reflection horizons have been selected. These reflections have been made use of, in generating interval velocity information using the methodology detailed above. The derived velocity values for different horizons are directly superimposed on the reflector horizons (Figure 2), to have clear vertical and lateral velocity variations in the region of the study.

From the details, it is evident that in the zone of CIS, considerable fluctuations in the horizon's configuration are noticed. Because of this, the thicknesses of the upper, middle and lower crustal columns show considerable variations. However, away from the CIS, on either side, one could clearly demarcate the probable horizons associated with the three different crustal columns. From the

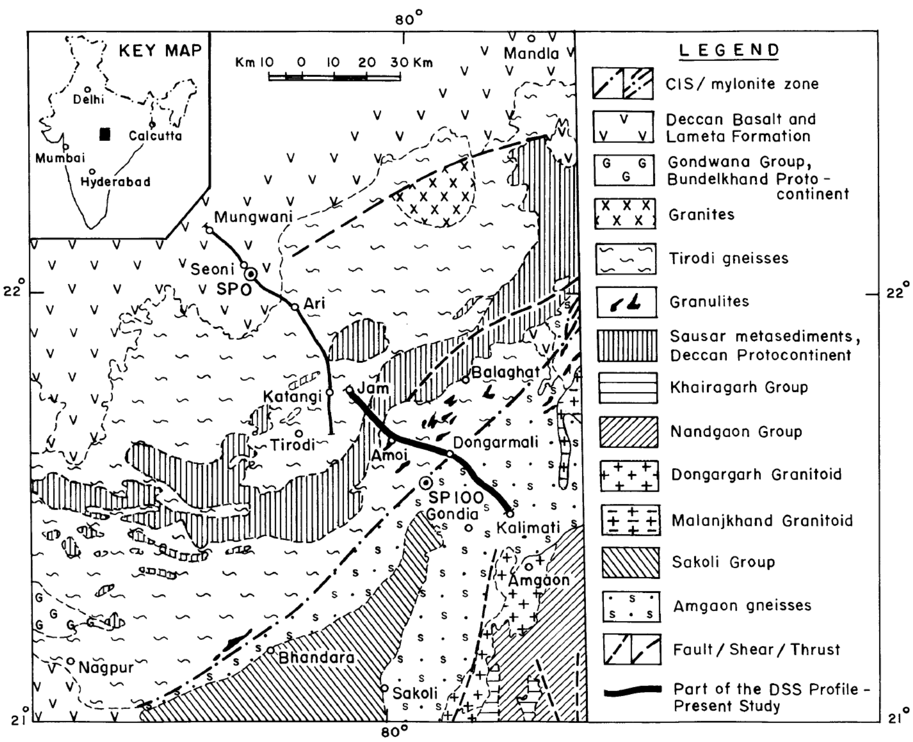

Figure 1. Location of the profile and the main geological features (after Reddy *et al.*[2]).