SHORT COMMUNICATIONS

T_c ENHANCEMENT IN Bi-Ni COMPOUNDS

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THE early work of Alekseevskii *et al*[1] showed the intermetallic phase Bi_3Ni to be superconducting with T_c of 4.06 K. Recently, Dumoulin *et al*[2] reported some preliminary data concerning superconducting tunneling conductance and the phonon electrical resistivity of Bi_3Ni having T_c of 4.2 K and have concluded it to be strongly coupled. Matthias *et al*[3] in early 1960s had found that normally nonsuperconducting Bi and Si and low T_c metals like Ti and Zr exhibit significantly enhanced T_c when they contain appreciable concentration of magnetic elements of 3d group. This was found most unexpected and inexplicable in terms of the microscopic theory where even very small concentrations of magnetic elements are sufficients to quench the time reversal symmetry of Cooper pairs. This led Matthias *et al*[3] to visualise the possible importance of magnetic interactions in superconductivity. Recently, the creative role of exchange interactions in the occurrence of superconductivity has been well emphasized by Ekbote and Narlikar[4-7], where antiferromagnetic interactions in the conduction band can lead to superconductivity and the pertinent model has been theoretically supported by Schmidt *et al*[8]. Further, T_c in the above model can be enhanced by shifting the localized magnetic moment to the conduction band. This suggests that in Bi-Ni compounds if the d band of Ni can be shifted to E_F, T_c might go up.

Following the above contention we synthesized a series of Bi-Ni compounds where the concentration of Ni was changed from 10 wt% to 35 wt%. The ensure the formation of Ni rich phases we used both splat quenching using gun apparatus as well the melt-spining technique.

The results of T_c measurement are depicted in figures 1 and 2. T_c Bi-10 wt% Ni (giving Bi_3 in atomic percent) showed the earlier reported T_c of 4.2 K. Increasing the Ni concentration to 20, 25 and 35 wt% the T_c was first increased and then decreased. The optimum T_c was observed for 25 wt% Ni (figure 2) having the onset at 10.3 K and the midpoint of the transition at 9.5 K. This sample was studied down to 2 K to see if there was any reentrant behaviour which was not observed, and it was found that at 4.2 K a relatively small field of 2 kOe was sufficient to restore the resistance. Amongst binary compounds containing 3d magnetic elements, T_c of 10.3 K is the highest ever reported. Other compounds of Bi containing Fe and Co however did not become superconducting down to 4.2 K. Studies on these compounds below 4.2 K is in progress. Detailed x-ray studies of Bi-Ni compounds will be reported elsewhere. However, all Bi-Ni compounds have primarily revealed the presence of orthorhombic phase where Ni ions are encapsulated by Bi ions.

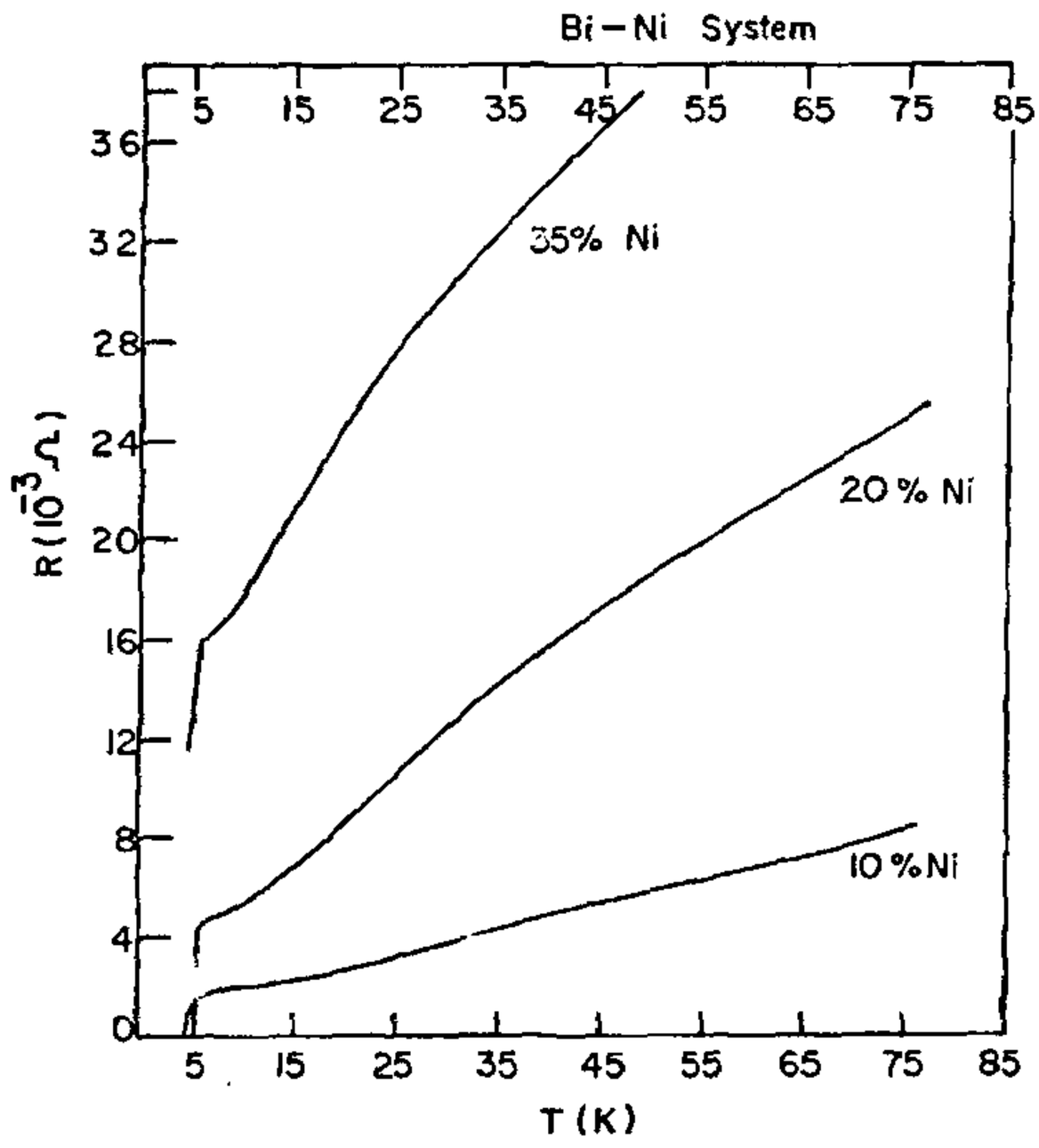

Figure 1. Resistance behaviour of Bi-Ni Compounds with temperature.

It seems intriguing how and why the above compounds containing significantly large concentrations of Ni are exhibiting such high T_c values. The samples are currently being studied using EPR and Mössbauer techniques to unfold the role of exchange interactions in superconductivity.

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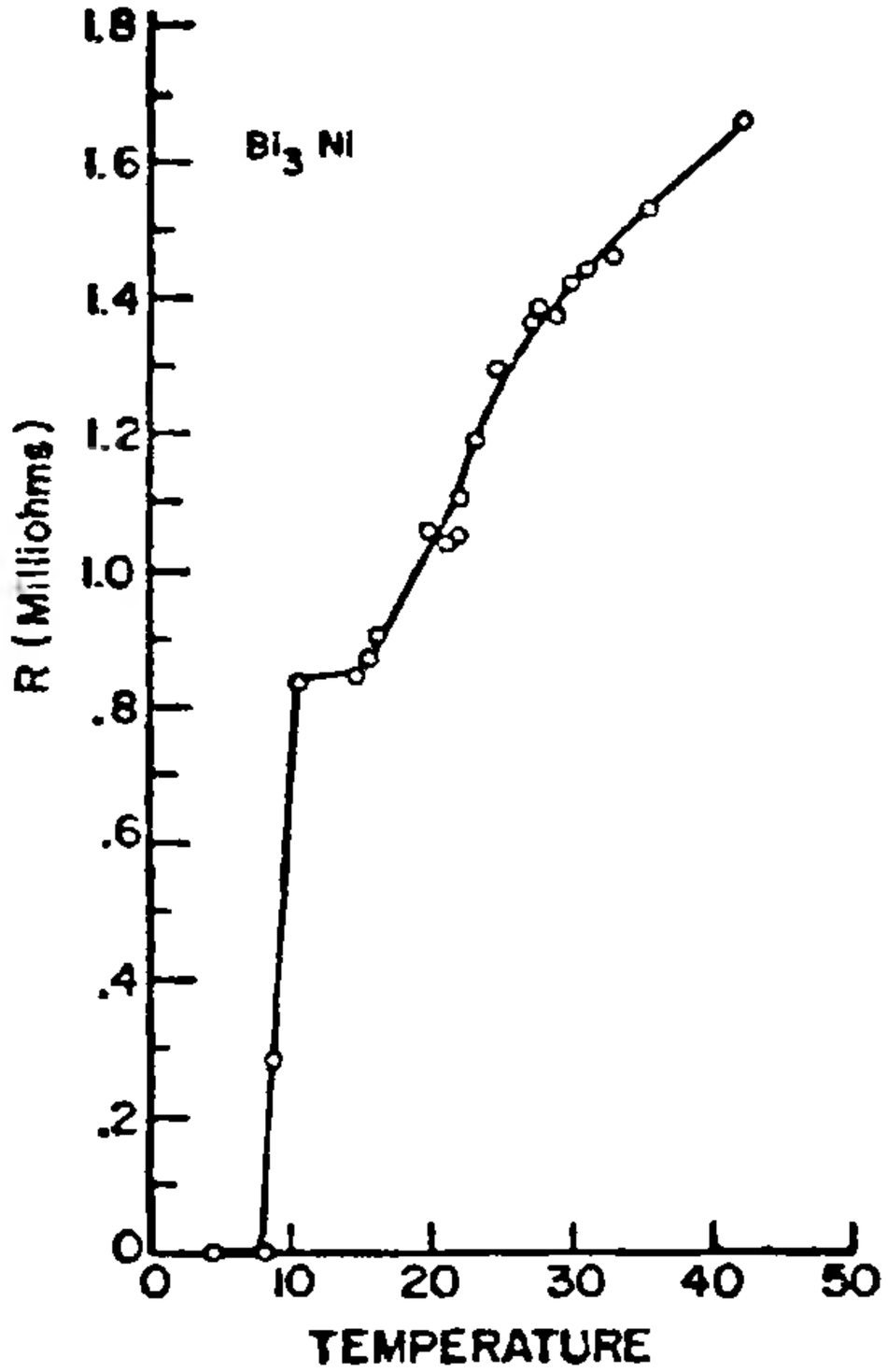

Figure 2. The onset T_c of 10.3 K for Bi–25 wt% Ni sample.

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MID-HOLOCENE FOSSIL WOOD FROM COLVA, GOA

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AMONG the major littoral formations of Goa, beaches form a prominent and a spectacular feature. The beaches found along the Goa coast are notably extensive, especially to the south of Bombay (19°N). Interpretation of the nature and evolution of the Goan beaches is difficult, because no residual form of the palaeo-features are visible on the surface. However, a recent discovery of a fossil wood at Colva (15°16'55" N and 73°56'18" E) is useful in this respect.

The fossil wood, (the first to be reported from this part) was found in a well excavation, about 550 m from the present high tide line. This was associated with a "black sandy horizon", about 6.5 m below the surface of a coastal dune (figure 1). The horizon con-

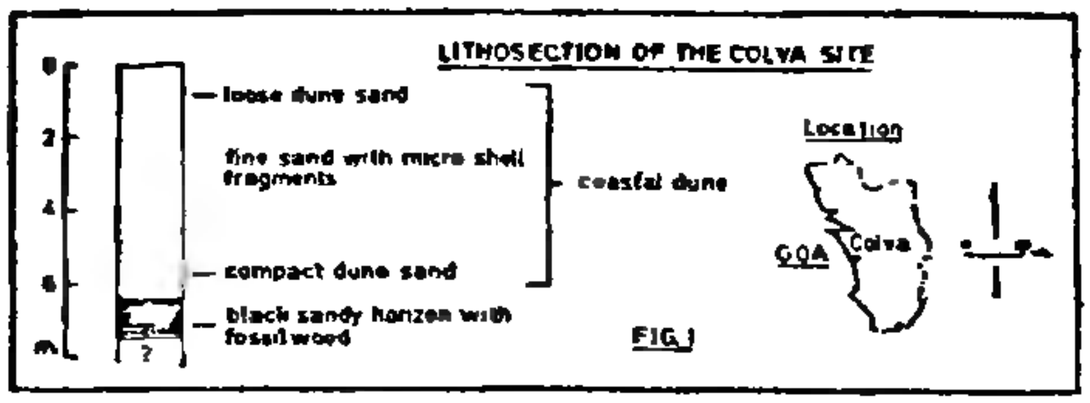

Figure 1. Location and the litho section of the Colva site.

stitutes, fossilized twigs in good proportion. The chemical analysis of the sample revealed that the pH was 2.9 and the conductivity was 4.2 millimhos/cm. The percentage of organic carbon was 0.336. Overlying this horizon is a layer of fine sand about 5 m in thickness. The fine sand also comprises microshell fragments. The dune sand is slightly hard, close to the fossil-wood-bearing horizon. Nevertheless, it loses its compactness at the top.

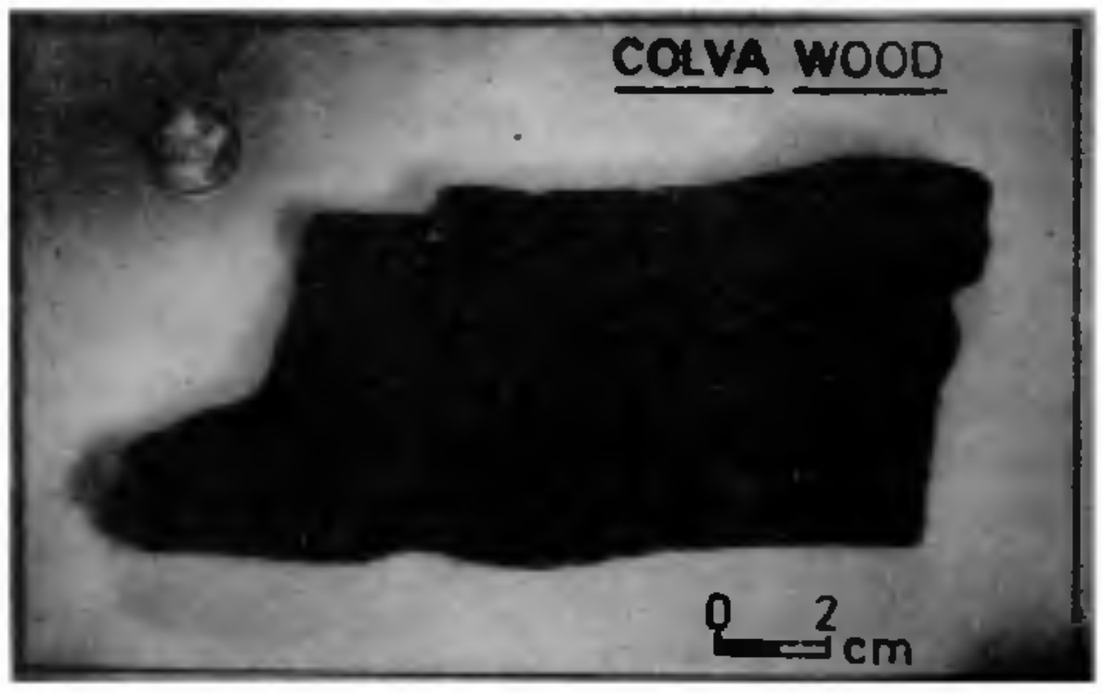

Figure 2. The Colva fossil wood

The fossil wood was date by the radiocarbon method as 6430 ± 110 years B.P. (BS–343). The location of the fossil wood in the lithosection demonstrates that the horizon lies about 1.5 to 2.5 m below the present sea level. Thus, the stratigraphic location of the Colva wood and the radiocarbon date of the wood suggest that during mid-Holocene the sea level was lower than the present.