HEAVY METAL CONTENTS IN THE SEDIMENTS OF NARAVA GEDDA STREAM, VISAKHAPATNAM, ANDHRA PRADESH, INDIA.

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VISAKHAPATNAM is now a big industrial city because of the harbour which has attracted a variety of industries. The present work is aimed at pollution hazards by studying stream sediments in three major streams around Visakhapatnam city, flowing into the Bay of Bengal. Study of stream sediments, is a common method employed to quantitatively assess concentrations of pollutants discharged from industrial effluents[1].

The methods earlier employed[2-4] were followed. Twenty eight grab samples of the stream sediments were collected during May 1983 from three major streams, the Narava Gedda Stream (figure 1) is highly polluted by the industrial waste while the other two, the Middle Stream and the Southern Stream, are comparatively free from any external contamination.

Since effluents discharged would normally affect the upper horizons of stream sediments, only the top layer of the sediments was sampled. The samples passing through a 120 mesh sieve were analysed for Cu, Pb, Zn, Ni, Cd, Mn, V, Cr, Fe, Mo and P and the results are given in table 1. The values of the two streams not influenced by any industrial activity are taken as the normal. Results are also compared with the average shale values established by Tuerekian and Wadepohl[5] which give the background values for any area.

Table 1 shows the quantitative enrichment of pollutants in the Northern Stream compared to the uniform background values in the Middle and Southern Streams. Molybdenum is uniformly low throughout, whereas manganese is high, more so in the Northern Stream due to the influence of Coramandel Fertilizer Plant, a potential contributor[6]. The Union Carbide Factory which was formerly located in the vicinity of the stream could have also contributed sufficient Mn. The Khondalite rocks may partly be responsible but this is insignificant as the Mn content[7] is between 0.99% to 3.7%. The tidal effects in the Narava Gedda Stream have thrown out of harmony the uniform reduction of toxic elements from the

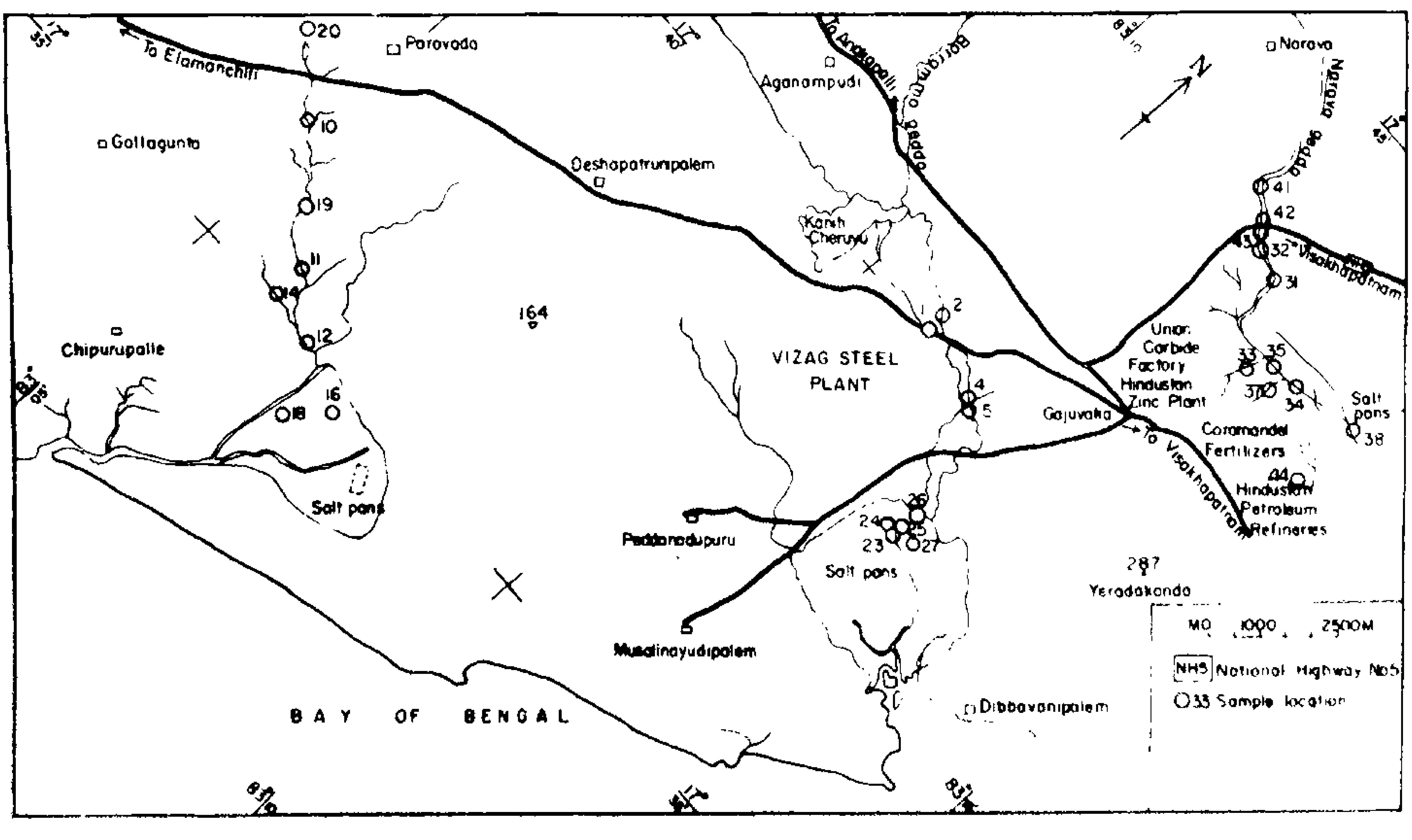

Figure 1. Locations of stream sediments samples.

Table 1. *Results of analysis of samples and their enrichment factor in ppm*

Element	Southern stream	Middle stream	Northern stream
Cu	47.5	47.77	527.72
Pb	72.5	71.11	3465.55
Zn	107.5	108.88	39300.00
Ni	45.0	42.22	66.36
Cd	<20.0	<20.00	54.10
Mn	932.5	675.55	1523.63
Mo	<10.0	<10.00	<10.00
V	135.0	137.77	116.36
Cr	225.0	197.80	228.20
Fe	57000.0	50300.00	57500.00
P	300.0	300.0	13000.00

proximal parts of the source of effluents to the distal parts, resulting in spreading of the elements upstream.

The alarming increase of heavy metal elements is undoubtedly due to the lead and zinc smelter plant and Coramandel Fertilizer Plant. The enrichment of phosphorus to the tune of 13000 ppm may well be the cause for the increase of nutrient, a significant factor for phytoplanktonic bloom in the harbour area as observed by Ganapathi and Raman[8].

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SPONTANEOUS SECONDARY SHOOT DEVELOPMENT FROM THE ROOT CELLS OF *BRASSICA* (RAPESEED-MUSTARD)

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AMONG the oilseeds, *Brassica campestris* Linn and *Brassica juncea* (Linn) Czern & Coss hold second position in area and production. The plant has a central tap root and a number of lateral spreads. The shoot is erect and bears primary, secondary and sometimes tertiary branches. There is no report on the production of secondary shoot from the root in *Brassica* under natural field conditions. This paper reports, for the first time, observations on the development of secondary shoots, from the naturally formed tumor-like body (mostly in the shape of bulb) on the root in a selection from an inter-specific cross of *Brassica*.

A cross between *Brassica napus* Metzger ($2n = 38$) and *Brassica campestris* Linn. ($2n = 20$) was made during 1979–80. The F_1 was partially fertile and therefore, F_2 population could be raised. Selections were made in F_3 onwards for fertile plants with hybrid characteristics. In 1984–85, selected F_5 plants were grown with usual crop practices.

Some plants showing secondary shoots arising from the root were observed. The new shoot always originated from the naturally formed tumor (mostly of the pea-grain size) on the roots (figures 1 and 2). The new shoots did not develop their own roots but enjoyed the translocation from the roots meant for main shoot through a direct vascular contact. Plants morphologically resembled more with the *B. napus* parent than *B. campestris* parent. For flowering and maturity the hybrid derivative occupied an intermediate position. From sizes of secondary shoots, it appears that they are formed largely during the later stages of plant growth but in a few cases they were also formed during earlier stages (figure 1).

The exact cause of origin is yet to be determined, but injury to the root cells by any pathogenic organism (bacteria, fungi and nematodes) could be the most probable reason leading to tumor development and consequent shoot formation. Such tumor induction, called crown gall formation on the shoot of dicotyledonous plant species, has been reported following infection with *Agrobacterium tumefaciens*[1-3]. The change in the phenotype of transformed tissues after incorporation of foreign genes (mesophyll protoplast