

Figure 4. Correlation diagram of Au/As, Gulaldih block/area, Sonbhadra Dist, UP

Such samples yield higher gold values but gold particles in them can be seldom seen and it cannot be recovered by panning.

The following two points emerge from the above studies: (i) Although the native gold blebs/particles are not easily detectable on megascopic scale, the geochemi-

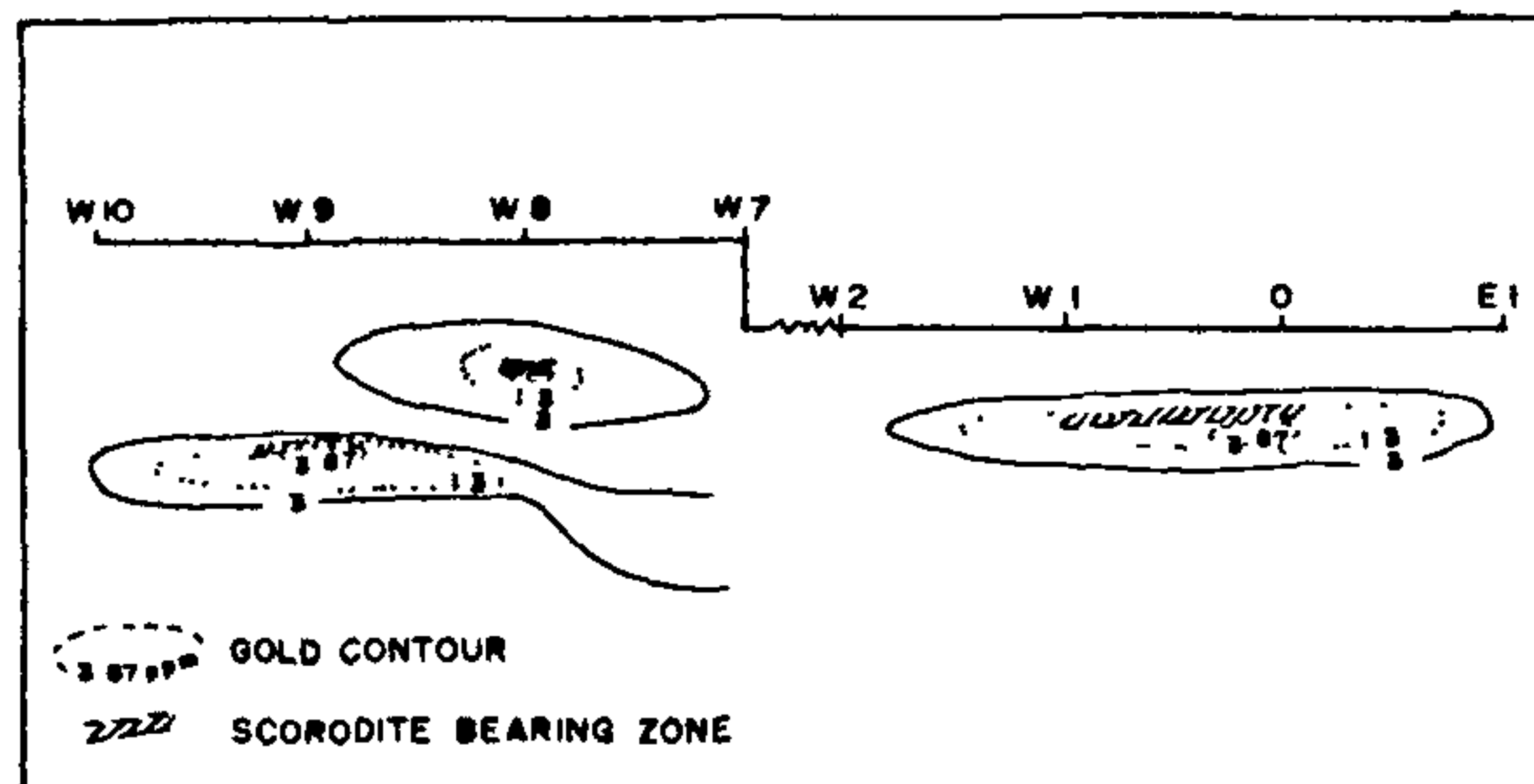


Figure 5. Correlation of scorodite occurrence with gold (values in ppm).

cal analysis of the scorodite samples show appreciable amount of gold in them. (ii) The higher values of Au and As match well with the occurrence of scorodite.

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## Melanophore indexing: A quick bioassay technique for detection of heavy metal toxicity

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A new easy bioassay technique using melanophore indexing has been devised for evaluating acute toxicity of the heavy metal salt, zinc chloride. The pigment cells show degeneration and lysis, thus pouring their melanin contents into the surrounding matrix of the connective tissue after 96 h of exposure which coincides with the maximum (50% of the population) death of the fish occurring under this concentration of 75 ppm.

STATISTICAL analysis of the mucocyte density of the skin and/or gill is one of the most traditional bioassay techniques<sup>1-4</sup> for testing water contamination. This however is a time-consuming complicated technique requiring

tedious mathematical calculations and expertise<sup>1,2,4</sup>. Hence it was felt that a more simpler bioassay technique be devised for quick analysis of the water samples. While making histopathological analysis of the toxicity of mercuric chloride on the skin and accessory respiratory organ of the live fish, *Heteropneustes fossilis*, Rajan<sup>5</sup> observed a periodical alteration in the structure and density of the melanophores due to destruction followed by their regeneration and suggested the need for a more comprehensive study of melanophore indexing for the purpose of testing waters contaminated with heavy metal salts. While studying the acute toxicity of zinc chloride on the histopathology of the skin of *H. fossilis*, we also observed marked periodical changes in their colouration and chromatophore morphology. Hence efforts were made to devise a quick technique of melanophore indexing for testing of waters contaminated with many, if not all, of the heavy metal salts.

Acclimated fish (length 12 cm) were treated with 75 ppm (96 h LC<sub>50</sub> value) of zinc chloride solution in tap water (temperature 22 ± 2°C, dissolved O<sub>2</sub> 8 mg/l and



**Table 1.** Variations in melanophore density/mm<sup>2</sup> of the skin (dermis) at different time intervals of 75 ppm of zinc chloride exposure

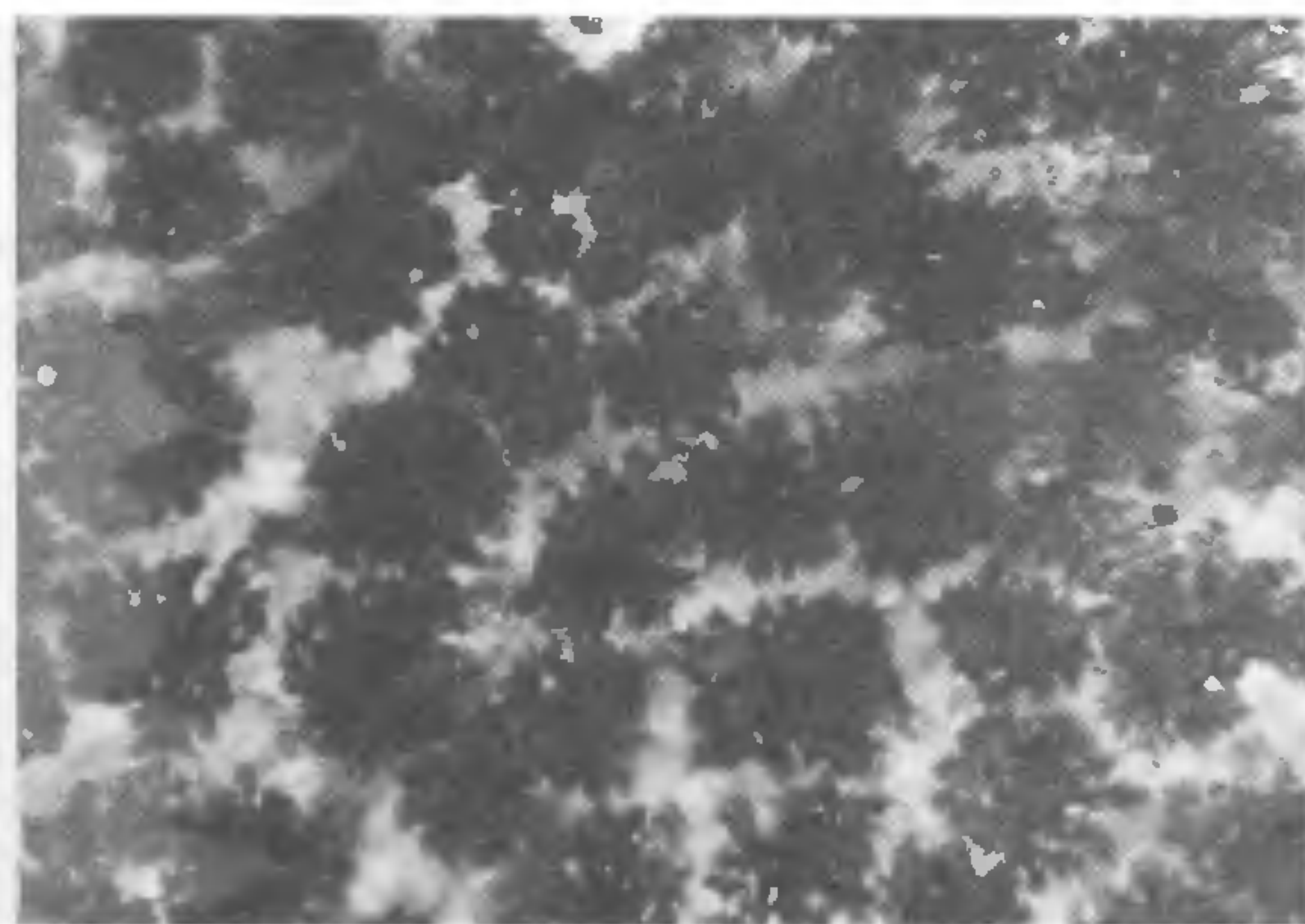
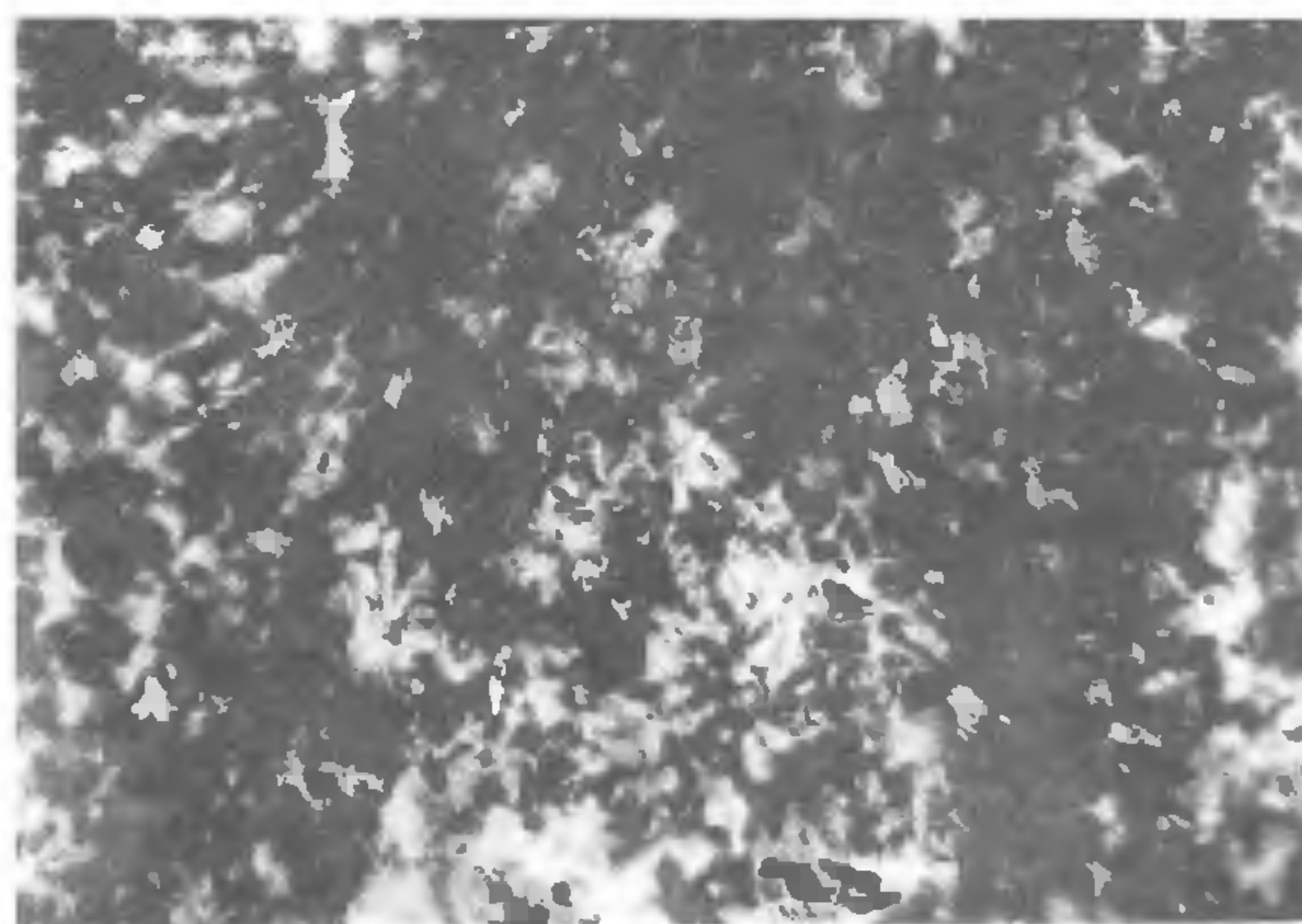
Control	3 h	6 h	12 h	24 h	48 h	72 h	96 h
405.83 ± 1.61	369.50* ± 6.48	414.16 <sup>ns</sup> ± 0.81	425.00* ± 1.5	428.77* ± 3.68	241.10* ± 0.59	461.71* ± 5.46	Degenerated due to lysis

Values are  $\bar{x}$  SEM of melanophores. The experimental values are compared with control values and comparison between different groups was made according to Duncan's multiple range *t*-test.

\**P* < 0.01; ns = not significant

**Table 2.** One way analysis of variance (ANOVA) showing significant changes in the melanophore density of skin at different time intervals of 75 ppm of zinc chloride treatment

Tissue	Source	Sum square (SS)	df	Mean square (MS)	<i>F</i>	<i>P</i>
Skin	Total	98400.25	20	—	—	—
	Between groups	97697.13	6	16282.88	301.03	< 0.001
	Within groups	703.12	13	54.09	—	—

**Figure 1.** Morphology of normal melanophores of normal untreated fish showing its stellate structure (×330)**Figure 2.** Massive breakdown of the melanophores following acute zinc chloride treatment for 96 h (×330)

hardness 23.25 mg/l) (controls exposed to tap water only). Melanophores were sketched on graph paper from alcian blue pH 2.5/PAS<sup>6</sup> stained permanent whole mount preparations of 0 h (control), 3, 6, 12, 24, 48, 72 and 96 h treated specimens, using a camera lucida.

Melanophores located mostly in subepidermal loose connective tissues of the dermis just below the basement membrane, appear as asteroid cells having tentacle-like processes of greatly variable length, radiating from their central body (Figure 1). They appear uniformly distributed keeping equal distance from their adjacent neigh-

bours, gorged with pigment granules within a tightly bound membrane.

Although the finger-like processes increase in their height considerably causing an interlacing of the processes of the adjacent cells after 12 h of exposure, there is not much alteration in the population of melanophores until 48 h of exposure when there is marked decrease (about 50%) in their population followed by their total lysis after 96 h (Figure 2) which coincides with the maximum (50% of the population) death occurring under this concentration (96 h LC<sub>50</sub> value). Due to lysis there is complete breakdown of the tentacular system making



it difficult to count their number (Tables 1, 2). Lysis of the pigment cells might be due to absorption of certain harmful substances (including zinc chloride), because melanin can bind with aromatic and cyclic compounds and cations<sup>7</sup>. Similar lysis and massive destruction of the melanophores following mercury salt treatment have also been observed by Rajan<sup>5</sup>. Hence evaluation of the phenomenon of total pigment cell lysis can be used as an important but simpler parameter for detecting acute toxicity of heavy metal contamination. The disintegration of the pigment cells might also point towards the important but undefined role played by them to combat the toxicity of the heavy metal salt and any breakdown of the barrier protective function (after 96 h) offered by these cells might be one of the major reasons for the death occurring in maximum number at this period. According to Roberts<sup>8</sup> melanophores also play an important role in the development of most skin lesions by virtue of their presence

immediately below the delicate epidermis, where they are subjected to traumatic damage of many kinds caused by several heavy metal salts<sup>9</sup>.

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## Kodomali kimberlitic diatreme, Raipur District, Madhya Pradesh

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Discovery of Bahradih, Payalikhand and Jangra kimberlitic diatremes in the Raipur district of Madhya Pradesh was reported in the News Bulletin of the Geological Survey of India, Central Region<sup>1</sup> (GSI News, March 1993). Another kimberlitic diatreme is being reported by the authors south of Kodapali village (location: Kodomali - 20° 11' 35" : 82° 15' 00", Toposheet No. 64 L/4), in the Mainpur Tahsil of Raipur district. This diatreme is almost centrally placed in the NW-SE trending lineament between Bahradih and Payalikhand and occupies a moderately vegetated topographic depression within a rolling granitic pediplained country. The only surface manifestation of the diatreme is in the form of concentration of specific heavy minerals of kimberlitic affinity in the soil profile.

THE Kodomali diatreme has an approximately circular outline more than 300 m across making it the largest of the four diatremes discovered so far. This diatreme like others is also enclosed within the Bundeli granite<sup>2</sup>. Unlike other diatremes which have yellow ground, the Kodomali diatreme shows fresh rock beneath 1 m veneer of soil.

The Kodomali diatreme exhibits typical kimberlitic

clast-matrix texture with clasts of ultramafic affinity, and macrocrysts of olivine (altered to antigorite), chromite, spinel, pyrope and enstatite with glassy nodules set in an aphanitic groundmass. Pyrope macrocrysts (up to 1 cm across) mostly show rounding effects resulting from magmatic corrosion of dodecahedral faces. Pyrope grains are also bordered by greenish kelyphytic rims. Unlike the Bahradih diatreme<sup>1</sup> the Kodomali diatreme rarely contains phlogopite and sanidine. The heavy minerals separated from the top soil include pyrope garnets of purplish, pink, red, red-orange and orange colours, chromite, spinel and enstatite.

In thin section, macrocrysts of fresh olivine with some serpentinization along cracks are prominently seen. Brown coloured clasts of ultramafic composition (mostly altered to serpentine) contrast with greenish aphanitic matrix. Heavily altered subhedral grains of low RI may indicate the existence of sanidine. Spinels show characteristic octahedral outline. Most of the clasts and macrocrysts show embayment features because of resorption by ultramafic groundmass. Flowage around macrocrysts and clasts is indicated by orientation of devitrified glass and string shaped opaques around the former. There is a general absence of the brecciated look unlike the rocks of Bahradih and Payalikhand diatremes. These characteristics are typical of hypabyssal facies kimberlites<sup>3</sup>.

As the Kodomali diatreme is exposed almost at the same level as the other bodies belonging to the diatreme facies, it is likely to represent a different pulse of kimberlitic emplacement. Payalikhand diatreme has been