

0.93 to 4.41 ppm. The Sandell's sensitivity is $0.008 \mu\text{g}$ of copper/ cm^2 and molar absorptivity is 7800.

Recommended procedure

To an aliquot of solution containing 9.2 to 44 μg of Cu (II) added excess of SH in acetone (50 mole), adjusted the pH between 7.5 to 8.7 with NaOH or HCl and raised the volume to 10 ml maintaining 75% (v/v) acetone medium. Measured the absorbance as 400 nm against the corresponding reagent blank and deduced the amount of the copper from the calibration curve.

Effect of foreign ions

For this purpose, solutions containing 31.5 μg of copper (II) and different amounts of foreign ions were used. The following ions, (ppm given in parentheses), did not cause deviation by more than $\pm 2\%$ in absorbance:

Br^- (500), Cl^- (500), IO_3^- (100), I^- (100), NO_3^- (300), NO_2^- (100), tartrate (14), SO_3^{2-} (500), Ca^{2+} (1000), Ba^{2+} (1000), Pb^{2+} (100), Cd^{2+} (100), Fe^{3+} (5.6), Fe^{2+} (25), Th (IV) (232), Ce(III) (26) and Mo(VI) (4.8). However, Bi^{3+} , Ni^{2+} , Co^{2+} , Mg^{2+} , Mn^{2+} , Al^{3+} , Zn^{2+} , UO_2^{2+} , phosphate, borate, thiourea, thiocyanate and platinum metals, were found to interfere seriously.

Determination of copper in alloys

Copper has been determined successfully in brass, bronze and copper-aluminium alloys by this reagent.

Procedure

Known amounts of analysed alloys were dissolved in concentrated HNO_3 . Excess of nitric acid was evaporated and the residue was heated twice with hydrochloric acid to get the chlorides. The copper content was determined as stated above. The following are the accuracy for the determination of copper in gun metal, brass and Cu-Al alloy $\pm 1.2\%$, $\pm 1.4\%$ and $\pm 0.8\%$ respectively.

Discussion

A search of literature reveals that many methods have been employed for the spectrophotometric determination of copper. Most important and widely-used reagents are 2, 2'-biquinoline, quinoline-2-aldehyde-2-quinolyl hydrazone, dithizone and rubeanic acid. 2, 2'-Biquinoline is quite selective reagent for copper and its sensitivity is fairly good ($0.010 \mu\text{g}$). Dithizone is one of the most popular organic reagent for the spectrophotometric determination of copper. Strong colour of dithizone and the medium stability of its solution are disadvantages. Complex of quinoline 2-aldehyde-2-quinolyl hydrazone is stable for one hour and its sensitivity is fairly good ($0.001 \mu\text{g}$).

Although salicylaldehyde hydrazone is not very selective reagent and gives colour reactions with many

other metals, yet it is a very sensitive reagent ($0.008 \mu\text{g}$) as compared to 2, 2'-biquinoline. The complex is more stable than quinoline-2-aldehyde-2-quinolyl hydrazone complex. Fe^{2+} and Cd^{2+} interfere in this method but in the case of SH these two ions do not interfere.

The authors are thankful to C.S.I.R., New Delhi, for financial assistance to one of them (HLR).

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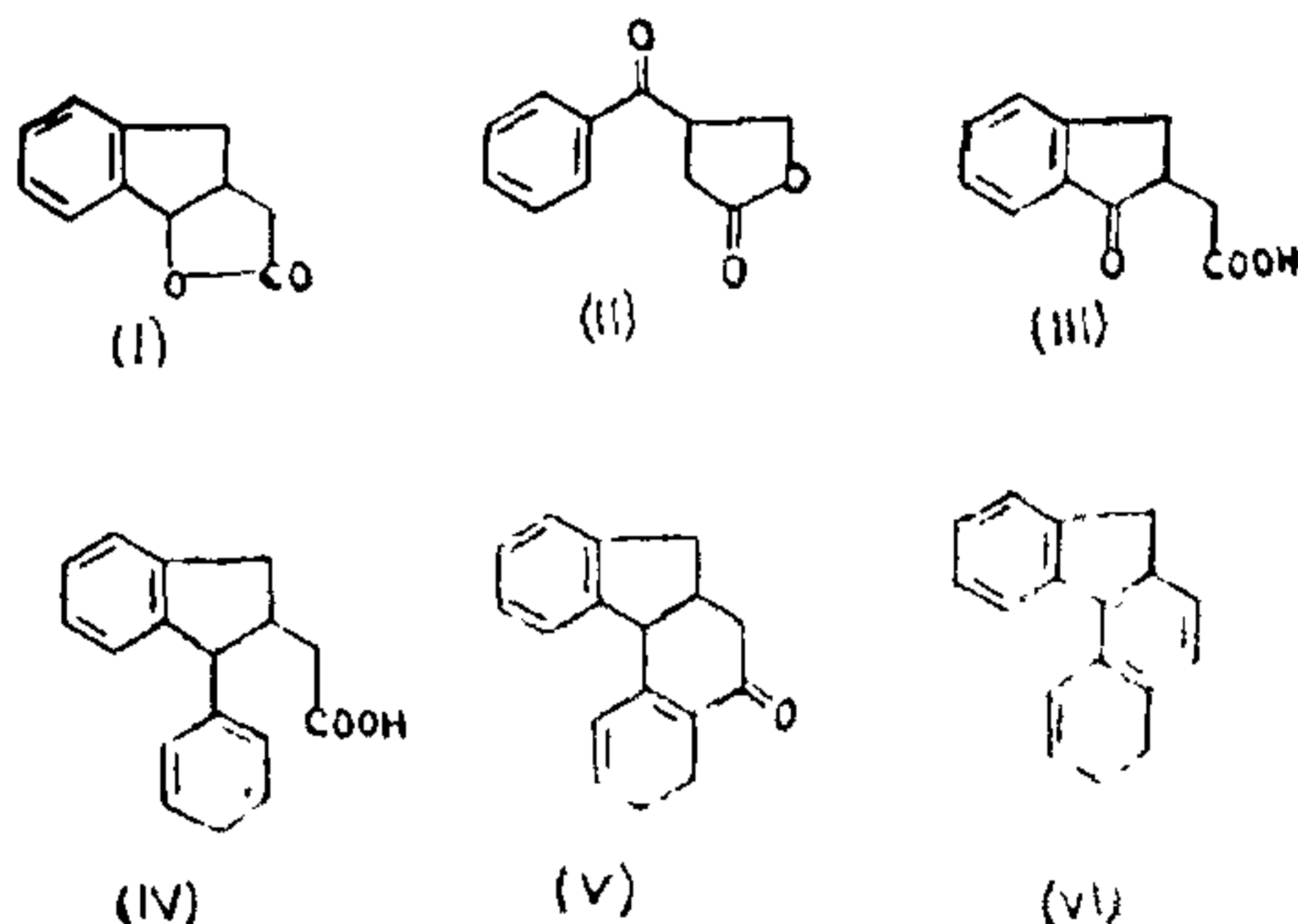
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FRIEDEL-CRAFTS ALKYLATION OF AROMATIC HYDROCARBONS WITH THE LACTONE OF CIS 1-HYDROXY-2-INDANYL ACETIC ACID

LACTONES derived from hydroaromatic compounds have been reported^{1,2} to be suitable materials for the synthesis of polycyclic compounds. The yield in all these cases was somewhat lower due to undesirable rearrangement taking place in the alkylation process. Rearrangement has also been observed during alkylation of aromatic hydrocarbons with the unsubstituted lactone of cis-2-hydroxy-cyclopentaneacetic acid³. In order to explore the possibility of utilising the Friedel-Crafts reaction for the synthesis of polycyclic hydrocarbons with fused cyclopentene ring *via* cyclic ketones using lactones, we have synthesised the lactone of cis 1-hydroxy-2-indanylacetic acid (I) and studied the AlCl_3 -catalysed alkylation of benzene with it.



The lactone (I) has been prepared from β -benzoyl propionic acid, m.p. 118°, obtained in excellent yield from benzene by succinoylation in presence of anhydrous

aluminium chloride. The potassium salt of this acid on treatment with formalin gave the lactone of β -benzoyl- γ -hydroxybutyric acid (II), b.p. 165/0.5 mm which crystallised from dry ether as white plates, m.p. 66°. Treatment of this lactone with concentrated sulphuric acid at 99° gave 48% of 1-keto-2-indanylacetic acid (III), m.p. 148°. Reduction of the acid (III) with NaBH_4 , followed by lactonisation of the resulting hydroxy acid in presence of sulphuric acid, gave a stereoisomeric mixture of the desired lactone of 1-hydroxy-2-indanylacetic acid, b.p. 160/3 mm, m.p. 66° (pet. ether), containing major amount of cis variety¹.

The Friedel-Crafts condensation of the lactone (I) with benzene in presence of AlCl_3 gave as expected, a secondary alkylate consisting of a stereoisomeric mixture of trans 1-phenyl-2-indanylacetic acid (IV), m.p. 156°, as the exclusive product, isolated through the ethyl ester, b.p. 150-53/0.5 mm, in 69.04% yield; amide, m.p. 173° (ethanol). The acid on PPA cyclisation afforded 66% of trans 2-keto-1, 2, 10, 11-tetrahydro-3, 4-benzfluorene (V) which crystallised from benzene as yellow needles, m.p. 135°; 2, 4-DNP, m.p. 236-37°. The structure of the ketone was confirmed by its reduction to the hydroxy compound, m.p. 140°, followed by dehydration and dehydrogenation by Pd-C (10%) to 3, 4-benzfluorene (VI), m.p. 123°; picrate, m.p. 129°.

A research grant by the Government of West Bengal is gratefully acknowledged.

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DISCOVERY OF PERMIAN FOSSILS FROM TAL NADI SECTION OF THE GARHWAL HIMALAYA, U.P. *

THE stratigraphy and structure of the Garhwal Himalaya is based mainly on the occurrence of fossiliferous beds associated with the Tal and Subathu Formations. The structure of this region has recently been considerably modified due to discoveries of fossils (Ganessan, 1972; Ravi Shanker *et al.*, 1973; Kalia, 1974 and Mehrotra *et al.*, 1976).

A recent collection from the Tal Nadi section, Garhwal Himalaya, Uttar Pradesh has yielded a rich bivalve fauna. This was made from the shale horizon of the rock formation which has been considered so far as Subathu of Eocene age. The collection includes *Eurydesma* cf. *mytiloides*, *E.* aff. *cordatum*, *E.* aff. *allatum*, *Megadesmus* (*Megadesmus*) *nobilissimus*, *M.* (M) sp., *Schizodus* spp. *Astartila intrepida*, *Astartila blatchfordi*. These fossils are comparable with the Lower Permian assemblage reported from the Agglomeratic Slates of Kashmir and Salt Range rather than the Eocene.

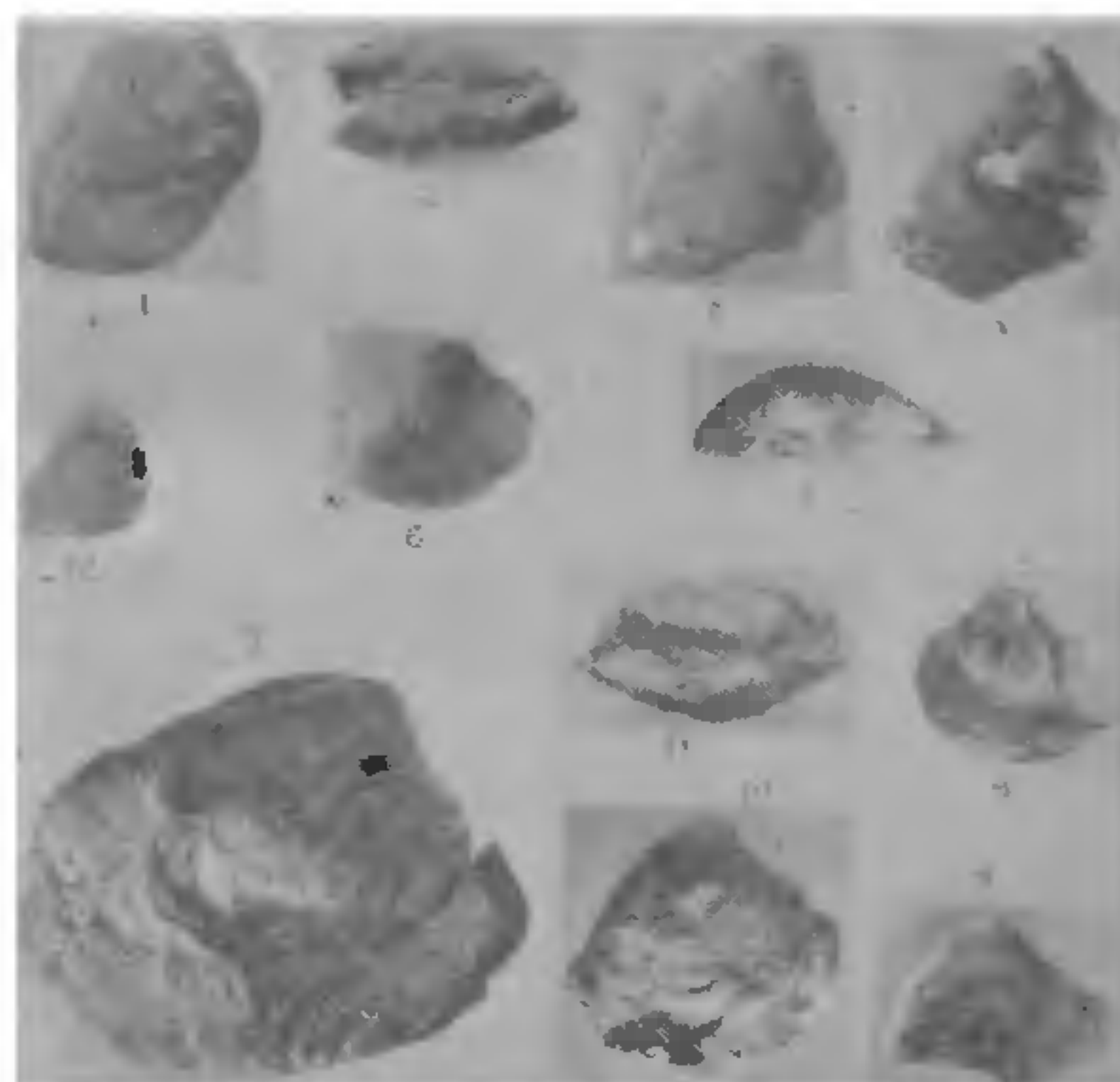


FIG. 1-12. 1-3, *Eurydesma mytiloides*; 4-5, *E.* aff. *allatum*; 6, *Megadesmus* (*Megadesmus*) *ovalis*; 7, *M.* (M) *nobilissimus*; 8, *Astartila intrepida*; 9-11, *Astartila blatchfordi*; 12, *Schizodus* sp. (All the specimens are reduced to $\frac{1}{5}$ of the natural size).

Preservation of these fossils is rather poor but definitely identifiable upto generic level. They are mostly internal casts and a few show attached tests. None of them is comparable with any of the Eocene or Cretaceous forms.

Prior to the present record, a number of publications on the Garhwal Himalaya have shown the presence of Devonian (Tewari)², Carboniferous (Ganessan^{2,3}) Permian (Kalia)⁴ and Mehrotra *et al.*⁵. This fossil find now fills the gap between the Carboniferous and Upper Permian, and confirms the existence of a continuous but overturned succession in the lower part of the Garhwal Nappe of Auden¹.

The Subathu litho-units mapped here mainly on the basis of the lithological similarity may, in part, contain the extension of these Permian beds now reported by the authors and, as such, needs re-mapping and re-interpretation of the stratigraphy and structure of the area as a whole. It may be mentioned here that the structure and tectonic evaluation of the Garhwal