STABILIZATION OF AUSTENITE BY ATOMIC HYDROGEN

THE stabilization of austenite in a steel by hydrogen cathodically generated at the surface was first reported by one of the present authors in a letter to *Nature* in 1961[1]. Subsequently the concepts, experimental techniques and results confirming the stabilizing effect of hydrogen on austenite have been discussed in detail elsewhere by Ramachandran, Dasarathy, Iyer and Ruge[1-6].

Stabilization was not observed when the hydrogen was introduced either by (*a*) merely equilibrating the steel in its austenite condition in hydrogen gas at pressures just above atmospheric pressure or (*b*) cathodic impregnation of steel in the ferritic state and heating it to the austenitic state before transforming to martensite. Stabilization has been found to occur when hydrogen is introduced cathodically just prior to transformation, *i.e.*, just above the M_s temperature of the steel.

TABLE I

Composition of steel : C 0·75%, Mn 1·0%, Si 0·15%, S 0·05%, P 0·05%. Size of sample : 1 cm diameter and 1 cm in length.

Treatment	Hydrogen ppm	Hardness-Vickers 30 Kg. Load
1. *Soaked at 1000° C in pure* argon gas, at very slightly above atmospheric pressure (about 5 cm of water gauge) for 60 min. and quenched in water at 22° C.	2	755
2. Soaked at 1000° C in a mixture of 97% pure argon gas and 3% pure hydrogen gas, at the same pressure as at 1 above but continuously electrically sparked for 60 min. and quenched in water at 22° C.	12	715

Not only are the pressures at which hydrogen is generated during electrolysis enormously high but the hydrogen itself is also, when nascent, in the atomic state. However, whether its entry into steel is due to the high pressure or atomic state, or both, cannot be deduced when hydrogen is introduced cathodically. A clearer concept may be formed if the stabilization behaviour of austenite can be examined when it is *separately interacted with* (*a*) atomic hydrogen at low pressure and (*b*) molecular hydrogen at high pressure.

This communication reports some experiments performed under condition (*a*) referred to above. The low pressure atomic hydrogen was obtained by creating a high voltage spark at a steel sample which was held in a mixture of 97% argon —3% hydrogen. The results given in Table I indicate that considerable stabilization of austenite occurs.

This result shows that atomic hydrogen generated under low pressure conditions can enter the steel and cause considerable stabilization of the austenite.

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DISCOVERY OF UPPER GONDWANA PLANTS, NORTH OF INDUS SUTURE ZONE, LADAKH, INDIA

THE present note records, for the first time, plant fossils from a small hillock along the left bank of Indus, about 50 km upstream of Loma, which in regional geological setting lies to the north of the Indus Suture Zone and also to the north of the linear belt of Ladakh Batholith. The fossils were collected by the authors (KKS and KRG) during their field work in this remote region of Ladakh.

A brief reference to the geology of this part of the region has been given by some earlier workers[1-2]. A more detailed account of the geology of the Shyok–Nubra valley in the northwestern continuation of the

present area has recently been given[3–6]. The area is characterized by the Ladakh Batholith, Shyok volcanics and associated volcanosedimentaries, the Palaeozoic metamorphites and the Karakoram axial granite, as the major rock units[3,4].

The sediments containing Gondwana plants are exposed as small detached hillocks. The base of these rocks is not exposed in the area under study but may be underlain by the Palaeozic metamorphites which are widely exposed in the adjoining region. The lithology of the rocks, as observed in the area, is represented by dark coloured quartzite, creamish quartzite, calcareous sandstone, conglomaratic breccia and carbonaceous shale. The youngest rocks exposed in the area are represented by northern molassic unit (reported for the first time) having alternating sandstone, conglomerate, grit and shale sequence, gently dipping towards southwest. This sequence unconformably overlies the Ladakh granite and/or Shyok volcanics and at places on the Upper Jurassic rocks of Gondwanic affinity. The geology of the area is complicated by a mega lineament, the Karakoram–Gandak Fault Lineament, which passes through the area[7–8]. The picture is further complicated by a series of NE–SW cross faults and subsequent development of geomorphic features along the wide valley of Indus (about 10 km) in this part of Trans-Himalaya.

The plant fossils come from a thin zone (about half a metre thick) within the carbonaceous shale member which overlies the arenaceous member forming the base of the Upper Jurassic rocks in this area. The plant fossils are represented by *Ptilophyllum cutchense* Morris (Fig. 1), *Ptilophyllum* sp., *Elatocladus* (sp.) cf. *E. plana* (Fst), Seward. *Taeniopteris* sp., *Brachyphyllum* sp. and a large number of equesetalean (like) stem impressions devoid of leaves or leaf sheaths. The presence of the above mentioned floral elements, etc. suggest an Upper Gondwana affinity for the fossil assemblage.

Lower Gondwana plants have been reported from Himalaya[9–12] and from two different localities in Tibet[13–14]. The rocks having Gondwana affinities have also been reported from Afghanistan and Iran[15]. It may, however, be mentioned here that Gondwana rocks, so far reported from the Himalaya, lie to the south of Indus Suture Zone, *i.e.*, the supposed line of collision between Indian and Eurasian plates[16], whereas the present find is from the north of the Indus Suture Zone.

The present find, if proved to have a regional extent across the Indus Suture Zone and if it may be correlatable with the other rock sequences of Gondwana elements reported from parts of Tibet and China[17], then the northern margin of the Gondwanaland would

FIG. 1. *Ptilophyllum cutchense* Morris.

extend further to the north of Tarim basin block along the Tien Shan[18] and the Indus Suture Zone would, therefore, be a relict of a Permian to Jurassic intercontinental rift zone rather than plate to plate boundary[19]. However, the small local extent of the presently discovered Upper Gondwana rocks, so far known from north of Indus Suture Zone, together with the complex tectonic setup of the area consequent to the Karakoram–Gandak Fault Lineament and other cross-faults possibly suggest it to be a detached fragment of Gondwana rocks from the northern margin of the main Gondwanaland which lies to the south of Indus Suture Zone and is represented by the rocks of the Upper Gondwana affinity from Muktinath area of Northern Nepal[11]. It, therefore, appears that the present occurrence is comparable to such occurrences in Iran and Afghanistan as reported by Stocklin[15,20]. The present finding therefore, possibly upholds Stocklin's contention of the presence of similar Gondwanic fragments east of Afghanistan. In the light of the observations of different workers[15,20–22], it may be suggested that three geotectonic regions can be demarcated[23], *viz.*, the *southern* Indian Sub-continental block, the *northern* Eurasian continental block and *in between* a mixed zone of Iran–Afghanistan–Hindukush–Karakoram–Ladakh (NE)—Tibet (Western) which has blocks of both Gondwanic and Siberian affinities.

The tectonic significance of the present discovery necessitates detailed investigation to trace possible extension of such rocks in the adjoining regions of Changtang Karakoram–Hindukush. The detailed geological and structural studies in NE Ladakh are in progress and the results thus obtained will throw more

light on the geodynamics of Indian–Eurasian plate boundary.

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PRELIMINARY INVESTIGATION ON THE ANTIMICROBIAL ACTIVITY OF A PHYTOCHEMICAL, XANTHOCHYMOL FROM THE FRUITS OF *GARCINIA XANTHOCHYMUS* HOOK. f.

PLANTS are known to provide a vast reservoir of potential drugs and not more than 10% of these have so far been examined in detail for their biological activity[1]. Recently some phytochemicals were found to exhibit antifungal activity[2–4]. *Garcinia* Linn. (N.O. Guttiferae nom. alt. Clusiaceae) is a genus of evergreen trees or shrubs distributed in the lower hill forests of Eastern Himalayas[5]. The oil is useful in skin diseases and bark is used as astringent[6–7]. Baslas and Kumar[8] isolated some new compounds from the fruits of this plant and this communication briefly reports the antimicrobial activity of xanthochymol.

The air dried fruits of *G. xanthochymus* were extracted with benzene. A compound was isolated from the concentrated benzene extract with petroleum ether (40–60° C) and was crystallised by hot petroleum ether (60–80° C) as shining pale yellow needles (m.p. 122–124° C). Molecular formula was $C_{38}H_{50}O_6$, molecular weight 602 and optical rotation +130 at 26° C. It was identified as xanthochymol by direct comparison of its IR, UV, NMR, and Mass spectra. The latest revised structure of xanthochymol by X-ray analysis[9] is shown in Fig. 1.

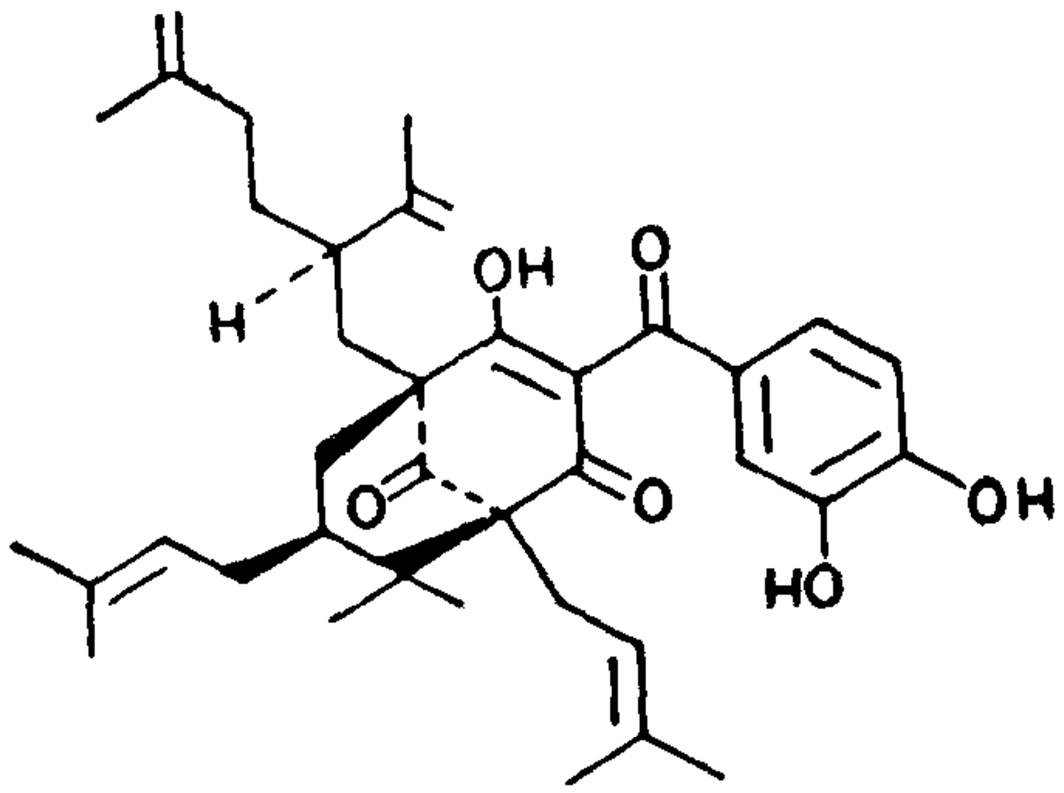

FIG. 1. Revised structure of xanthochymol by X-ray analysis after Blount and Williams (1976).

For a preliminary investigation of the antimicrobial activity of xanthochymol *in vitro*, two bacteria: *Streptococcus faecalis*, *Klebsiella pneumoniae* and three fungi: *Candida albicans*, *Trichophyton mentagrophytes* and *Aspergillus fumigatus* were used as test organisms following the method described by Dhar *et al.*[10]. Tetracycline and amphotericin B were used as standards for the comparison of antibacterial and