

CHEMICAL FORMS OF ARSENIC IN MARINE ORGANISMS, WITH EMPHASIS ON *HEMIFUSUS* SPECIES

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ABSTRACT

Investigations of arsenic in spindle shells (*Hemifusus tuba* and *H. ternatanus*) in Hong Kong have revealed moderate to high concentrations of total arsenic in soft tissues. Levels of inorganic arsenic vary considerably between the tissues in these gastropods, being very high in the gill but much lower in the foot. The significance of these data in terms of public health is discussed. In addition, the uptake of inorganic arsenic from solution by *H. tuba* is described. The importance of the precise chemical speciation of arsenic in marine biota is emphasized, and the forms of the element reported to date in marine environments are reviewed. A novel hypothesis is described to account for the derivation of all forms of arsenic found in marine organisms to the present. It is proposed that these diverse compounds all arise from a single anabolic/catabolic pathway concerned with the biosynthesis and turnover of phospholipids.

KEYWORDS

Inorganic arsenic; organic arsenic; arsenobetaine; arsenocholine; arseno-sugars; *Hemifusus*; gastropods; spindle shells.

INTRODUCTION

The toxicity of arsenic to Man has been recognised for several hundred years. In inorganic form, the element is mutagenic, carcinogenic and teratogenic. It also elicits a variety of sublethal effects in Man, such as peripheral neuropathy. On a biochemical level, arsenic uncouples oxidative phosphorylation and combines with sulphhydryl groups of enzymes. The trivalent form of the element is generally considered to be more toxic than the pentavalent form.

Marine organisms contain large amounts of arsenic compared to terrestrial biota (Lunde, 1977). The potential toxic hazard from arsenic in seafoods was first studied by Chapman (1926) and Coulson *et al.* (1935), who reported rapid excretion of the majority of the arsenic ingested with marine products by humans and rats. However, it is now known that arsenic exists in a variety of chemical forms in marine biota; the toxicology of several of these has not been fully studied to date. The possibility therefore remains that certain forms of arsenic in seafoods may pose a toxic hazard to Man.

This paper reports the tissue distributions of inorganic arsenic and total arsenic in spindle shells of the genus *Hemifusus*. Two species of this genus (*H. tuba* and *H. ternatanus*) are common in Hong Kong. These are capture-fished by trawlers from silt substrates of coastal waters at depths exceeding 20 m; they are sold as luxury food items on retail fish markets. Maximum shell length is about 40 cm. They feed on bivalve molluscs (Hamada, 1977); large individuals are probably 10 or more years old. Phillips *et al.* (1982) previously reported