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Bromophenol accumulation and sediment contamination by the marine annelids *Notomastus lobatus* and *Thelepus crispus*

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Abstract

The occurrence of bromophenols in *Notomastus lobatus* and *Thelepus crispus* and associated sediment and porewater was determined. 4-Bromophenol, 2,4-dibromophenol, and 2,4,6-tribromophenol were identified in *N. lobatus* with the highest concentrations occurring in the anterior and posterior abdomen and substantially less in the thorax (345, 209, and 6.6 μg/ml of worm, respectively). The concentration of dibromobenzyl alcohol was highest in the tail (last 15 setigers) of *T. crispus* (1.02 mg/ml of worm), but did not differ among body parts as the bromophenols did in *N. lobatus*. Concentrations in sediments were significantly reduced from those in the worms and decreased from the inner burrow lining out to 5 cm from *N. lobatus* burrows. Similarly for *T. crispus*, concentrations of dibromobenzyl alcohol in the surrounding sediments and porewater were low and increased with proximity to the burrow. For both species, concentrations in surface sediment (upper 1 cm) did not differ from those at 6 cm depth. Several lines of evidence indicate that these compounds are produced by the worms and

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hence their presence in sediments is derived from the worms. The contamination of sediment by these bromophenols has important implications for the structure and activities of benthic-associated communities.

Keywords: *Notomastus lobatus*; *Thelepus crispus*; Sediment; Bromophenol; Bromobenzyl alcohol; Porewater; Contamination; Polychaete

1. Introduction

The production of secondary metabolites by marine organisms has received increasing attention, particularly because of their numerous ecological roles, including defense and prey identification (Pawlik, 1993; Hay, 1996; Faulkner, 2002). In addition to accumulation in the organism, secondary metabolites may be released into the surrounding air, water or sedimentary environments, where they may serve additional ecological roles in intra- and inter-specific interactions among individuals (Woodin et al., 1997). Although the ecological functions of terrestrial soil-borne metabolites have received attention (Rice, 1984; Siqueira et al., 1991), the contamination of marine sediments by infauna is much less well characterized.

The dominant macrofaunal organisms of marine sediments include the very abundant, infaunal polychaete worms. These worms, in common with many other marine organisms, produce halogenated metabolites (Woodin et al., 1987; Hay, 1996; Fielman et al., 1999; see reviews by Faulkner, 2002 and references therein). Two sediment dwelling polychaete species were chosen for study, *Notomastus lobatus* and *Thelepus crispus*, because previous studies have shown that they produce bioactive bromophenols (Steward et al., 1992; Woodin et al., 1993). Further, these two species have been shown to contaminate the sediments of their burrows and surroundings to an extent sufficient to influence other biota. For example, surface sediment that has been exposed to *T. crispus* is rejected by potential recruits of the polychaete *Nereis vexillosa* (Woodin et al., 1993), while contamination of the burrow lining and surrounding sediment by *N. lobatus* may stimulate the presence of microflora which decompose the bromophenols (Steward et al., 1992). The objectives of the current study were to assess accumulation in the worms of their principal secondary metabolites and to determine the extent to which nearby sediment is contaminated by their bromophenols. Both worm species are large (>10 cm in length) and abundant in their habitats: *N. lobatus* is found in muds and muddy sands from North Carolina to the Gulf of Mexico and southern California to Mexico (Ewing, 1984), while *T. crispus* is found in mixed fine sand-gravel sediments from Alaska to southern California (Hartman, 1969; Moore et al., 1980).