

# Effects of heavy metals on sea urchin embryo development. 1. Tracing the cause by the effects

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## Abstract

The toxicity of the polluted waters originating from a disused lead mine was evaluated using both sea urchin bioassays and heavy metal analysis. Samples from three polluted waters (a seawater and two freshwaters) were collected from the mine area and one seawater sample was taken from a non-contaminated reference site. The test waters contained higher concentrations of heavy metals such as manganese, lead, cadmium, zinc, chromium, nickel, iron, and copper than did ambient seawater. The three test waters had inhibitory effects, in a dose-dependent manner, on the first cleavage of sea urchin embryos and on pluteus formation during the development. Some malformations, such as a radialized pluteus, exo-gastrula, and spaceship Apollo-like embryos were induced by the test waters without dilution. Zinc alone also induced the same anomaly. Zinc in the test seawater was ascertained as one of the metals that caused the anomalies, but not all of the toxicity was caused by zinc. It was speculated that interactive effects, involving zinc and possibly manganese and nickel, were occurring.

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## 1. Introduction

Many methods are used to judge the degree of pollution of the sea. One approach is to take measurements of physical or chemical characteristics of the water, such as measurements of water temperature, pH, COD, and concentrations of heavy metals. While this approach leads to a specific value for each characteristic, the interpretation of this information is difficult. It is impractical to analyse all the possible constituents of the water, because of the time and cost of the work. Fur-

thermore, there may be synergistic or antagonistic actions of chemical substances. On the other hand, bioassays can detect the toxicity of very low concentrations of known pollutants, or even the effects of unsuspected pollutants that are difficult or impossible to detect by chemical analysis. The sea urchin is one of the most suitable test organisms for acute bioassays of marine pollution (Kobayashi, 1971, 1990, 1995; Kobayashi et al., 1972). Different anomalies in sea urchin development are induced by polluted waters containing various heavy metals. These anomalies at different developmental stages of sea urchin eggs, embryos, and adults may act as indicators in the bioassay. For example, deficiencies in embryonic development in sea urchins from the waters of the Bay of Brest were linked with environmental factors such as heavy metals (Quiniou et al., 1999).

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