Statoliths ("earstones") are small aragonitic structures found in the head of cephalopods providing a sense of balance. They grow throughout the lifetime of the animal and deposit daily increment rings [1]. The characteristic trace element patterns in statoliths are supposed to be governed by the composition and temperature of the surrounding sea water [2]. Thus statoliths may reflect the changing environmental factors such as temperature and salinity, and may be used to study the distribution and migration pathways of cephalopods.

We have performed rearing experiments with cuttlefish (*Sepia officinalis*) under controlled temperatures and salinities, in order to determine the effect of such environmental conditions on the composition of statoliths. Our trace element analyses of statoliths from reared cuttlefish provide first experimental evidence that statoliths can in fact be used as internal tags for the reconstruction of migrations [3]. Synchrotron X-ray Fluorescence Analysis (SYXRF) was used to determine the distribution of minor and trace elements in the cuttlefish statoliths. Doubly polished, 40 micrometers thick statolith sections were analysed at the SYXRF set-up at HASYLAB Beamline L, using white synchrotron radiation and a glass capillary producing a beam diameter of about 12 micrometers.

Our results show that Ba/Ca ratios are negatively related to temperature (Fig. 1), and do not show a relation to salinity. Strontium, however, shows no relation to both salinity and temperature, suggesting that the well established proxy strontium is not as useful in cephalopods statoliths as in other marine aragonites.

SYXRF provided a spatial resolution of 12µm combined with detection limits down to 0.5 ppm. The excellent micro-scale resolution and the precise analysis of elements from Calcium (Ca) to Lead (Pb) makes SYXRF a very accurate tool to gather life history information of individual cephalopods from statoliths. A major advantage of the SYXRF method is that the analysis is non-destructive, thus allowing for further investigations of the analysed sample material.
Figure 1: Ba and Sr concentrations measured by SYXRF in the distal part of the statolith lateral dome of laboratory-reared *Sepia officinalis*, expressed as Ba/Ca and Sr/Ca ratios, respectively. Water temperature and salinity is given. Points represent means of five specimens with six analytical spots each. Error bars represent standard deviation.

References