# NWA 2999, an angrite with unusual bulk chemistry or a new type of achondrite?

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## Introduction

NWA 2999 is classified as an angrite based on mineralogy and oxygen isotopes [1]. Chemical data indicate differences in bulk chemistry to other angrites, making this a unique meteorite.

## Chemistry

Major elements were determined by XRF, trace elements on a different sample by INAA. For analytical procedures see [2,3]. Compared to average angrite, the Mg content is significantly higher, Si and the refractory elements Ca, Al and Ti as well as P are much lower. Unlike other angrites, NWA 2999 has abundant FeNi-metal, and corresponding levels of Ir, Au, Ni and Co.

## Interpretation

Mixing calculations with average angrite composition were performed: Delivering the excess siderophiles is possible by contributing 8 % of the mass by an iron meteorite. But this is unlikely, because it cannot explain the high Mg and the low Ca, Al and Ti contents.

Adding more than 60 % of a primitive meteoritic component would have diluted the refractory elements to the measured values and led to the high Mg, Cr and siderophile element contents. The added component could have lost its P by metal-silicate equilibration before the metal was incorporated in NWA 2999. However the assumption of more than 60 % of external matter is difficult to reconcile with the angritic oxygen isotopic data and the low contents of volatiles.

An alternative view is to take both components from the same parent body. A differentiated lithology with elevated Ti, Ca, Al and REE, but with low Mg, Cr and almost no Ni and Ir is mixed with a core-mantle component, high in Mg, Cr, Fe, Ni, Au and Ir of the same parent body. Mixing could be the result of a large impact on the APB.

Another yet possibility is an origin from a different, until now unknown parent body, which is similar to angrites with respect to mineralogy and oxygen isotopes.

## References

[1] Kuehner S.M. *et al.* (2006), *LPS* **XXXVII**, #1344.
[2] Wolf D. and Palme H. (2001) *MAPS* **36**, 559-572.
[3] Korotev R.L. *et al.* (2006) *GCA* **70**, 5935-5956.

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# Physicochemical Speciation of Iron in the Baltic Sea

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Size fractionated classes of Fe in surface water at two stations, one in central Baltic Sea (the Landsort Deep) and one in Bothnian Sea, were measured from spring until autumn to evaluate temporal variations in the physicochemical speciation. Membrane filtration, cross-flow ultrafiltration and DGT (diffusive gradients in thin films) were among the applied techniques. Average concentrations for total, <0.22 and <1kDa Fe were 32, 7.0 and 5.9nM respectively at the Landsort Deep. For the Bothnian Sea, these figures were 96, 21 and 6.2nM. DGT-labile concentrations of Fe were significantly lower than <1kDa at both stations. This probably indicates that a large portion of the DGT-labile Fe was organic bound, which would slow down the diffusion rate. The DGT-labile Fe concentration was on average 0.6 nM at Landsort Deep, and 1.0 nM in the Bothnian Sea. If assuming that all DGT-labile Fe was bound to fulvic acids the concentrations becomes about 5 times higher, but still lower than <1kDa. No clear trends were observed for the DGT measured concentrations. In both areas the concentration of Fe in all but the DGT-labile fraction decreased 60-80% towards end of the sampling period. Average ratios between total Fe and <0.22µm were about 4-5 at both stations, but in the Bothnian Sea also a clear difference between <0.22µm and <1kDa was observed, indicating a significant colloidal fraction. At the Landsort Deep, a peak of <1kDa Fe was evident in end of July, despite stable total concentrations during the summer. A small peak of <1kDa Fe was also observed in the Bothnian Sea, but not as clear as in Landsort. These peaks coincide with drops in biomass, indicating that this is a mineralization event. We hypothesize that the difference in concentration between DGT-labile and <1kDa is caused by organically bound species that are influenced by the presence of phytoplankton.