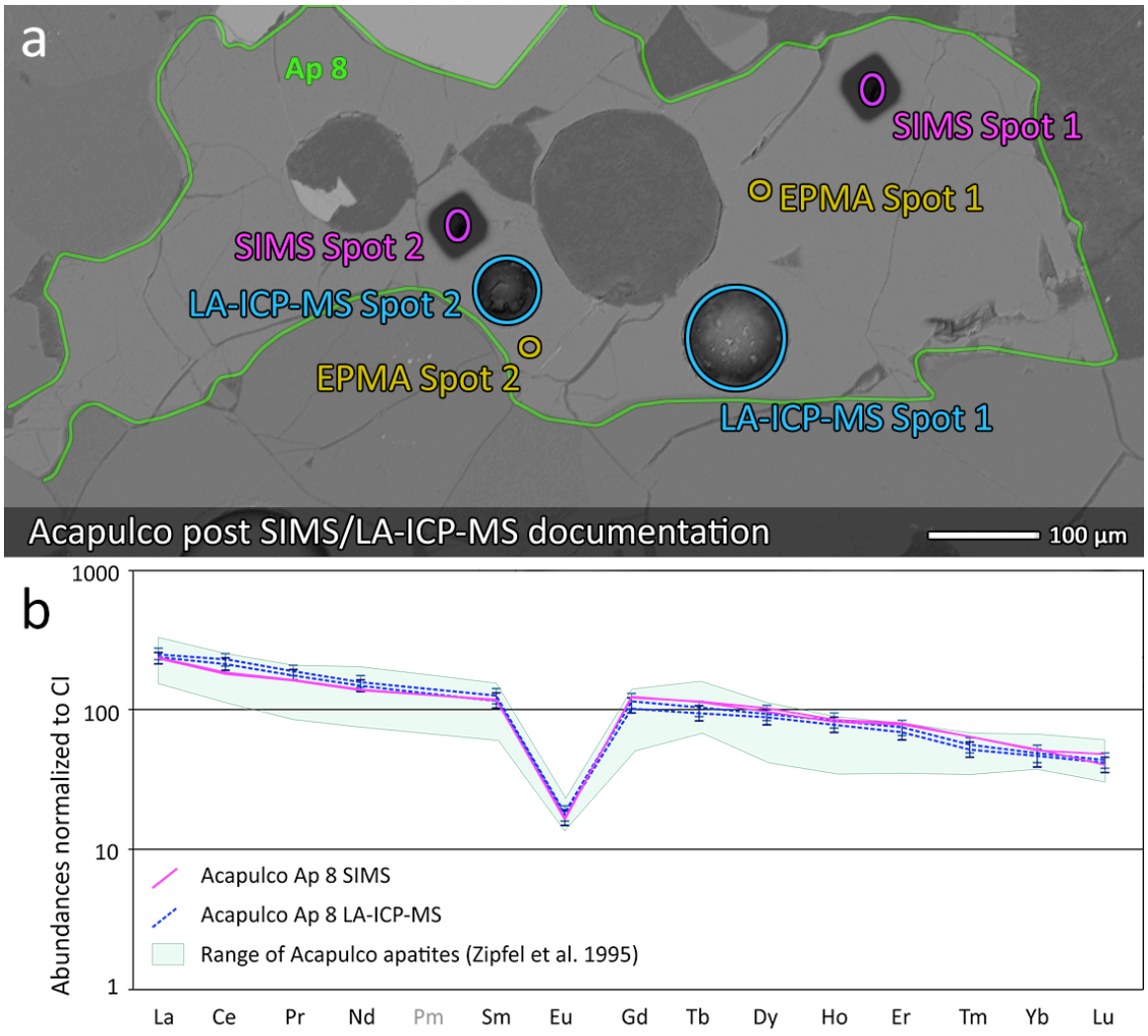
SUPPLEMENTARY TABLE S4. Average REE abundances of the major REE carrier phases in the ALM-A ureilitic trachyandesite normalized to CI (values used for normalization are from Barrat et al. 2012).

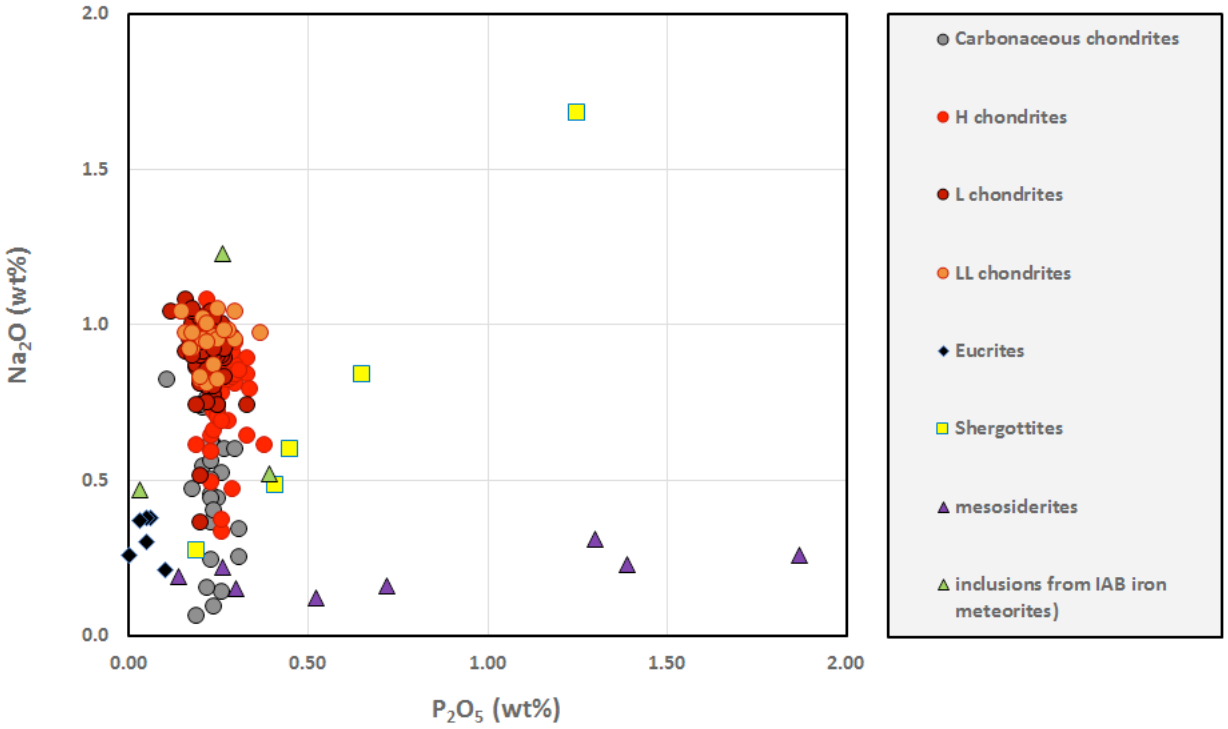
Mineral	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Ap (n=5)	256.4	202.7	166.6	143.7	98.7	25.5	92.5	80.3	68.7	65.1	58.7	48.2	45.3	46.0
Fsp (n=7)	1.9	1.2	1.1	0.6	0.7	10.2	1.0	0.5	0.3	0.4	0.4	0.5	0.5	0.8
low Ca Px (n= 4)	25.6	23.3	19.9	18.0	15.5	4.4	16.0	15.9	14.9	16.8	18.1	17.7	20.6	24.3
Ca-Px (n=7)	4.8	5.6	6.4	6.5	8.1	1.2	10.1	11.2	12.7	13.3	15.0	14.4	17.4	19.2

Reference:

Barrat, J.A., Zanda, B., Moynier, F., Bollinger, C., Liorzou, C., and Bayon, G. (2012) Geochemistry of CI chondrites: Major and trace elements, and Cu and Zn isotopes. Geochimica et Cosmochimica Acta, 83, 79–92.



Supplementary Fig.1 On selected grains, multiple analyses were performed with SIMS, as well as with LA-ICP-MS. **(a)** Post-SIMS secondary electron- SEM image of an exemplary apatite grain in the Acapulco meteorite. The apatite grain boundary is marked with the green, solid line. After the measurements were conducted, the position of the spots was checked at the SEM in order to ensure they were on target and not on grain boundaries or inclusions. The LA-ICP-MS spots (55 and 85 µm) are marked blue, while the SIMS spots of ~15 µm are outlined in magenta. The position of the EPMA analyses is labeled in orange. **(b)** Chondrite normalized REE patterns corresponding to the spots labeled in (a). The error bars represent the 2σ-errors. Obtained analyses for this grain overlap within error (except the LA-ICP-MS results show minor positive variation in Ce and minor negative variation for Tm) and are consistent with the range of literature data published by Zipfel et al. (1995).



Supplementary Fig.2 Bulk range of the Na_2O vs P_2O_5 content from the meteorite groups analyzed. Data from Jarosevich (1990). Note the restricted range in P for most meteorite groups, except mesosiderites and shergottites, but significantly more variable Na contents. This variability is also reflected in the observed Ca-phosphate chemistry, especially in merrillites (c.f. Fig. 4), and is correlated to the formation conditions and genesis of their host rocks.