

THE UNIVERSITY of EDINBURGH

Integrating tephrochronology with environmental and historical data: Tephrabase and dataARC

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www.tephrabase.org



Tephrabase (launched in 1995) currently holds details of 6000 tephra layers found in Iceland, Europe, and Mexico. The data includes spatial and stratigraphic information, physical descriptions of tephra layers, chronology and geochemistry, and details of volcanic sources. Originally, Tephrabase concentrated on spatial and geochemical data. This has been expanded to include more descriptive information about tephra layers, in addition to new sites and tephra layers, The tools available and underlying technology have also been updated.

New tools in Tephrabase have added value to the data held. Tephrostratigraphic columns can be generated automatically (below). Using tephrochronology, sediment accumulation rates (SeAR) can be used to study timings and changes of past soil erosion. Tephrabase automatically creates SeAR graphs (right) and calculates annual accumulation rates for suitable, tephra-dated Icelandic soil profiles, thus helping us to better understand human-environment interactions in one of the last settles and most eroded parts of the world.

Tephrabase is a stand alone database, that can be made even more useful when combined with other datasets from a wide range of different, but relevant, disciplines. Tephrabase is an integral part of the dataARC project, which is addressing this challenge.



Sediment accumulation rate graphs created in Tephrabase which can be used to estimated local soil erosion rates in Iceland. Detailed data are displayed below the graphs.





Hekla 1104 Tephra in Iceland This search has found \$2 analyses The results of your search are shown on this page, which is divided into three sections. The first contains geoch electron probe microanalyses of the the tephra layer you have chosen, which can be downloaded. Most of these shorts. The second section or was information about the instrument conditions and the thruit details about the sou

<u>View Mexican tephra sites.</u> Tephrabase has details of tephra layers at 982 sites within Europe (including Iceland).



Location of European tephra sites. The concentration of sites from eastern France to southern Sweden largely contain the Laacher See Tephra.

Details of tephra layers found at Hrísheimar, near Mývatn (Iceland). Information provided includes depth of layer, both correlated and local names, characteristics of the layer and link to geochemical data (if available).



Stratigraphic column automatically generated for sites near Sólheimajökull, Iceland. The system shows the correlated and local names for the tephra layers and identifies cryptotephra and tephra layers that are only present in trace amounts.

SiO ₂	TIO ₂	Al ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	K ₂ O	P205	Total	EP	R
75.20	0.21	12.18	1.79	0.07	0.04	1.07	4.21	3.43	0.02	98.22	16	358
74.28	0.23	11.15	2.72	0.09	0.10	1.01	3.97	9.57	0.02	97.16	16	358
73.63	0.19	13.89	3.16	0.14	0.11	1.67	4.50	2.65		99.94	2	130
73.32	0.19	14.10	3.23	0.14	0.10	1.86	4.25	2.74		99.94	2	96
73.28	0.16	14.10	3.25	0.10	0.09	1.84	4.39	2.65		99.87	2	96
73.26	0.17	13.91	3.22	0.12	0.13	2.03	4.56	2.50		99.91	2	96
73.18	0.20	14.23	3.03	0.13	0.10	1.83	4.47	2.70		99.87	2	96
73.18	0.29	13.90	3.21	0.14	0.15	1.85	4.14	2.84		99.70	2	130
73.03	0.22	14.12	3.12	0.10	0.16	1.81	4.40	2.56		99.52	2	130
73.01	0.12	13.94	3.23	0.14	0.13	1.98	3.98	2.73		99.26	2	130
73.01	0.22	13.84	2.84	0.11	0.12	1.97	5.00	2.84		99.94	2	96
72.95	0.21	14.10	3.18	0.08	0.14	1.89	4.22	2.69		99.45	2	96
72.91	0.18	14.43	3.08	0.04	0.09	1.98	4.60	2.43		99.75	2	96
72.90	0.23	13.80	3.08	0.05	0.11	1.93	4.40	2.81		99.31	2	96
72.88	0.23	13.63	3.33	0.10	0.14	1.79	5.02	2.87		99.99	2	96
72.88	0.23	14.02	3.04	0.13	0.13	2.08	4.00	2.73		99.24	2	96
72.85	0.21	13.92	3.12	0.08	0.11	2.03	4.30	2.67		99.27	2	96
72.84	0.21	14.36	3.18	0.09	0.11	1.88	4.06	2.80		99.51	2	96
72.71	0.23	14.16	3.27	0.07	0.13	2.01	4.48	2.69		99.75	2	96
72.68	0.17	14.03	3.22	0.13	0.13	1.99	4.19	2.57		99.12	2	96
72.65	0.18	13.80	3.12	0.07	0.10	1.93	4.19	2.60		98.64	2	96
72.62	0.15	13.85	3.31	0.16	0.17	1.91	4.34	2.68		99.19	2	130
72.52	0.21	13.70	3.27	0.13	0.12	1.82	4.41	2.77		98.95	2	130
72.51	0.15	14.19	3.28	0.10	0.13	2.05	4.77	2.68		99.84	2	96
72.47	0.21	13.87	3.25	0.11	0.12	1.87	4.18	2.60		98.68	2	130
72.45	0.14	14.01	3.36	0.12	0.14	1.78	4.15	2.81		98.96	2	130
72.39	0.18	14.75	3.15	0.11	0.10	2.07	4.48	2.70		99.92	2	96
72.39	0.22	13.51	3.40	0.11	0.16	1.89	4.01	2.57		98.25	2	96
72.36	0.23	13.97	3.06	0.17	0.15	1.85	4.68	2.81		99.28	2	96
72.29	0.27	13.75	3.13	0.08	0.10	1.97	4.70	2.76		99.06	2	96
72.29	0.19	13.70	2.97	0.04	0.10	1.94	3.56	2.70		97.47	2	96

Geochemical data of the widespread Hekla 1104 (H1) tephra layer in Iceland.



www.data-arc.org

dataARC's central aim is to foster interdisciplinary and collaborative research on long-term human-ecodynamics of the North Atlantic, including Iceland, through the development and integration of digital resources and tools. Research included ranges from environmental geography, to tephrochronology to palaeoclimate modelling, to archaeology, and saga studies. This NSF-funded project develops and builds on the interdisciplinary research and cooperation of the NABO research collective (www.nabohome.org). Tephrabase is integrated into dataARC to utilise the chronological control that tephrochronology provides for archaeological and palaeoenvironmental studies in Iceland and beyond.

Other data sources being incorporated into the dataARC discovery portal include the NABONE zooarchaeological database, the Orkney Faunal Database, the Strategic Environmental Archaeology Database (SEAD www.sead.se), the Icelandic Sagas Database (sagadb.org), the Icelandic Saga Map (sagamap.hi.is/is) and the Iceland Farm Histories Database. As well as linking these datasets, NSF grant is supporting the uploading and exporting of data into Tephrabase, the rewriting of code which delivers the webpages and handles searches, the further development of tools and porting of the entire database from Oracle to the open source PostgreSQL system. New environmental tephra data and archaeological tephra data from Iceland is also being added.











A dataARC priority has been to define a shared data model and conceptual framework from which to build links across multidisciplinary data. An example of the project's concept mapping (left) illustrates the connection between tephra layers and tephrochronology and other data in dataARC. Dr Rachel Optiz (PI) at the University of Glasgow leads the conceptual and semantic developments, which create the linkages between our varied datasets.

dataARC will create a data portal which will allow searches to be made across varied datasets, breakdown compartmentalisation and thus allow 'wicked problems' and Grand Challenge research agendas to be tackled more effectively.

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