

Tillaga að verkefni á nýjan vegvísi um rannsóknarinnviði 2025

Titill verkefnis:

ICAN: Iceland Centre for Analysis of Natural materials

Heiti stofnunar:

Institute of Earth Sciences, University of Iceland

Vinsamlegast hafið eftirfarandi atriði í huga við gerð tillögunnar

Umsækjandi þarf að svara öllum liðum hér að neðan. Þar sem stendur „Texti“ er hægt að skrifa texta, setja inn myndir eða töflur.

Tillögum að innviðum á vegvísi um rannsóknarinnviði skal skilað á þar til gerðu eyðublaði. Ekki er leyfilegt að eiga við uppsetningu eyðublaðsins.

Skjalið „Tillaga að innviðum á vegvísi um rannsóknarinnviði“ skal að **hámarki vera þrjár blaðsíður, auk forsíðu, eða samtals fjórar blaðsíður**. Nota skal leturgerð og leturstærð eins og stillt er í eyðublaðinu, þ.e. 11 punkta Calibri (body). Ekki er leyfilegt að breyta breidd spássíu eða beyta fyrirsögnum í eyðublaðinu. Umsókn skal senda inn sem PDF-skjal.

Festur til að skila inn tillögum er til 12. september 2024, kl. 15.00.

Nánari upplýsingar er að finna á [heimasíðu Innviðasjóðs](#) og hjá sérfræðingum Innviðasjóðs hjá Rannís í gegnum tölvupóstfangið innvidasjodur@rannis.is

Lýsing á tillögu til birtingar á heimasíðu Innviðasjóðs

1. Samantekt: Stutt lýsing innviðum

Iceland, as a unique natural laboratory, has played a fundamental role in the development of many fields of geochemistry, including its application to the solid earth, hydrothermal systems, volcanic processes (e.g., rapid response to volcanic crises), and the role of weathering in the global carbon cycle. While much of this work has been led by Icelandic researchers, the limited infrastructure available in Iceland has slowed innovation and increased costs, as we must rely on overseas facilities. Though our existing facilities are used extensively and contribute to high profile publications, the scope the research undertaken is necessarily limited. The Rannís Road Maps provide us with an opportunity to establish a national facility that will be devoted to comprehensively characterising complex natural materials for their chemical and isotopic compositions. This new centre, **ICAN: Iceland Centre for Analysis of Natural materials**, will bring together three units hosted at the Institute of Earth Sciences (IES), University of Iceland (UI): (i) Plasma Center, (ii) Microbeam Center, and (iii) Fluids and Volatiles Center. The new centre will promote collaboration within and outside of IES, across the fields of geochemistry, ecology, and archaeology. The Rannís Road Map will allow us to significantly strengthen each of these units by purchasing state-of-the-art instruments: (i) High Resolution Multi Collector Inductively Coupled Plasma Mass spectrometer (HR-MC-ICP-MS), (ii) Thermal Ionization Mass Spectrometer (TIMS) (iii) Laser Ablation Inductively Coupled Plasma Mass Spectrometer (LA-ICP-MS) and (iv) laboratory and mobile multi-gas analysers. The proposed infrastructure will play a central role in the research programme of the leading applicants, graduate students, and postdocs at IES, and will also support a large number of Iceland-based collaborators in the fields of geology, chemistry, volcanology, geothermal energy, carbon capture, environmental chemistry, material sciences, ecology and archaeology for the coming decades.

2. Meginmarkmið með uppbyggingu innviða?

The main objective of this proposal is to strengthen our capabilities to chemically characterise complex natural materials in Iceland in order to maintain and further Iceland's role as a leader in geochemical innovation and research. This represents both a continuation of the recent renovations and upgrades to all of the centres mentioned above, made possible by the financial support of Rannís (e.g., grants #161325-0031; #171507-0031; #200313-6201, #232839-901) and the UI, but also a step-change in the facilities available to Icelandic scientists. Key objectives in achieving this goal include:

- Expand the capacity of the plasma centre to measure a wide range of novel stable isotope systems and uranium series isotope systems by obtaining a HR-MC-ICP-MS.
- Expand the range of materials from which we can obtain radiogenic isotope ratios (e.g., tiny mineral inclusions, or low element abundance samples), by establishing a TIMS facility.
- Expand the micro-analysis capabilities to trace elements by acquiring an LA-ICP-MS.
- Install high-precision volatile gas analysers of major and trace compounds (H-O-C-S-Cl-F-N-noble gases) and acquire mobile and field deployable volatile analyzers for near-continuous monitoring of gases/fluids of volcanic, geothermal, and environmental interest.

3. Hvernig mun innviðaupbyggingin stuðla að nýliðun og leiða til aukins samstarfs og betri nýtingar innviða?

The proposed infrastructure will allow us to capitalise on the potential of Iceland as a natural laboratory without costly and time-consuming trips to overseas facilities. This improvement will be felt most by postdocs and graduate students who will be able to achieve substantially more in the limited duration of their projects. This will make Iceland a much more attractive host for international early career scientists and improve their chances of obtaining competitive European funds. The new center will increase the scope and competitiveness of funding proposals from Iceland-based researchers, particularly ERC funding calls, providing further employment opportunities. Previous funding awarded by Rannís for building up the analytical infrastructure at IES has promoted collaboration between different institutes based on a broad range of applications involving geochemical analysis, including volcanic gas monitoring (Veðurstofa Íslands), the sources of fluids and their reactions in geothermal systems including CO₂ sequestration (IES, Carbfix, LV, HS Orka). Further investment will strengthen these collaborations and promote new collaborations. For example, there are cutting-edge analytical approaches being applied in ecology, CO₂ management, marine biology and archaeology that are yet to be explored in Iceland. In addition to the main applicants, co-applicants, users of the new infrastructure will include UI staff in diverse fields such as geology, geography, biology and marine biology and archaeology, as well as partners in government institutes (Hafrannsóknarstofnun, Veðurstofa Íslands, Náttúrufræðistofnun Íslands, Fornleifastofnun Íslands), the private sector (ISOR, Landsvirkjun, Orkuveita Reykjavíkur, HS Orka, Carbfix), and the GRÓ Geothermal training programme (UNESCO).

4. Hverju munu innviðirnir breyta miðað við stöðuna í dag?

Investment from Rannís and UI in recent years has led to incremental improvements in the facilities available at IES. This includes the establishment of a metal-free clean laboratory, instruments for analysing major and trace elements in bulk samples (ICP-MS and ICP-OES), and maintenance of a first generation MC-ICP-MS capable of measuring a limited suite of isotope ratios in bulk samples, and electron-beam facilities for in-situ major element analyses. These facilities are used extensively within UI and by external collaborators. The proposed infrastructure will significantly expand these capabilities (including spatially resolved trace element analysis, and lower detection limits on a much wider range of isotope systems). The most significant changes that will arise from this include:

- New opportunities for Iceland to lead innovative and multidisciplinary geochemistry research and use this as a basis for attracting funding from outside of Iceland (e.g., the ERC).
- Provide up-to-date training in geochemistry for students and early-career researchers, allowing us to remain competitive in attracting promising students and postdoctoral researchers to UI from within and outside of Iceland.
- Reduce preparation and analysis costs for methods already established.

Examples of research avenues this will open to us, include:

- Developing isotope tools for tracing degassing processes and emissions in volcanic systems, contributing toward hazard forecasting.
- Establishing stable isotope monitoring of CO₂ injection and emissions as a routine tool.
- Applying in-situ measurements to understanding ore deposits and geothermal scaling, as well as materials relevant for corrosion science and chemical engineering
- Establish geochemical tools to study archaeological artefacts to address early colonization as well provenance histories in archaeometallurgy.

- Applying trace element and isotope systems in ecology to differentiate mixed populations, determine migration pathways, and reconstruct exposure temperature histories. While aspects of these applications can be undertaken (at greater cost) overseas, others require the rapid feedback that having the instrumentation present in Iceland will achieve.

5. Framtíðarsýn uppbyggingar og reksturs

The facilities will be housed in the Askja building at UI and will be supported by the existing preparation labs at IES. This includes a metal-free clean laboratory (Rannís grant #161325-0031), unique to Iceland. The Microbeam Center already has many of the facilities necessary for preparing samples for LA-ICP-MS analysis. The Fluids and Volatiles Center has sample preparation facilities in place for chemical and isotope analysis. Across the three centres, the existing instrumentation will support the new instruments in providing basic sample characterisation. The Road Map will provide the opportunity to improve the efficiency with which these facilities operate. The new infrastructure will be a national facility open to all potential users, made available through the existing infrastructure booking system (<https://jardvis.hi.is/is/innvidir-og-oryggi>) with analytical fees collected per hour of use or per sample. Access will be prioritised for Rannís and ERC funded projects. The expertise required to operate these instruments is already in place within IES (gained from working in overseas facilities), with daily maintenance undertaken by the experienced technical staff at IES. The facility managers already have experience in operating the existing centres.

6. Áætluð fjármögnunarpörf næstu ár

(i) Plasma Center (2025)

HR-MC-ICP-MS	Accessories		TOTAL (MISK)
110 MISK	20 MISK		130
TIMS	Accessories		
120 MISK	20 MISK		140
Laboratory and sample preparation			
5 MISK			5

(ii) Microbeam and in-situ Center (2026)

LA-ICP-MS	Accessories		
55 MISK	3 MISK		58
Laboratory and sample preparation			
15 MISK			15

(iii) Fluids and Volatiles Center (2027)

Multi-gas analyzers (MGA)	Accessories		
25 MISK	3 MISK		28
MiniRuedi GC-MS	Accessories		
10 MISK	1 MISK		11
Portable-multi-gas analysers (FMGA)	Accessories		
13 MIKR	3 MIK		16

(iv) Technical support (2025-2027)

Technician			30
------------	--	--	----

Estimated total cost (2025-2027)

433