Main Applicant: Jamie Allen
Project Title: Shift Register: Media-geological Grounding of the Anthropocene through Artistic Research

1. Summary of the research plan

'Shift Register' is an artistic research project that renders sensible the proposed markers of the Anthropocene, a new geological epoch marked by irreversible Earth-magnitude changes caused by human activity. Anthropocene markers (AMs) signal geoscientific, geopolitical, geosocial and ecological novelty. They are material and conceptual inscriptions of exchanges between Earth's geologies and human beings, behaviors, and thinking. 'Shift Register' directly and critically encounters the Anthropocene, 'shifting the register' and status of its markers from symbolic, scientific fact toward their reality as aesthetic, media-technical geoscientific and climatological methods, practices, instrumentations, and data. Critical, media-epistemological, artistic research and 'sensory anthropological' perspectives are used to look at personal-cultural and sensory-informational spectra of the Anthropocene and its evidential sites: our ambiguous, even celebratory fascination with determining a singular, static, human-selected marker that, in fact, should mark an exhaustion of obstinate, deterministic human endeavour. We attempt here, instead, an 'unmonumentalisation' of the proposed markers of the Anthropocene, bringing them 'down to size' by *doing* and *documenting* the media-technical activities of geoscience, shifted into hands-on Do-It-Yourself (DIY) science, as artistic research strategy. 'Shift Register' is a novel approach to Anthropocene research, reasserting the radical, dynamic nature of material Earth processes.

The onset of the Anthropocene is "primarily an aesthetic event."[1] Artistic praxis is a principal means by which we frame experience, and how we confront and characterise the problematic of 'ends' and 'beginnings'. 'Shift Register' is a research platform that brings modes of artistic research into dialogue with global Anthropocenic debates, through the investigation of AMs as spatio-temporally localised conjunctions of History (as a domain of the Humanities), Natural History (Geology, Biology, Chemistry, Physics) and Culture (Art, Aesthetics, Communications Technology). AMs constitute Earth-signals—material-informational 'responses' to the 'impulse' of anthropocentric and anthropomorphic activity. Earth-signals are read back as rock, soil, biomass, water, ice and air—documents from the Earth-as-media-archive. Infospheres and technospheres[2] are always already geological; subterranean and atmospheric regimes are inscribed as in formation, as ancient biospheric 'tree-rings', antecedent atmospheres frozen in ice, and radioactive rippling of bygone cataclysms. AMs are not only geoscientific determinations, but complex, eco-aesthetic archives of psycho-geotrauma,[3] intersecting numerous knowledge domains.

Artistic, citizen-science laboratory and fieldwork research methods for geo-ecological sciences are here framed toward 'unmonumentalising' the Anthropocene, by emphasising the aesthetic (as in *aisthesis*) centrality of media-technical knowledge production in both Science and Art. The global Anthropocene is returned to the wild locality of anthropogenic life, via self-built toolset development and documentation, and a Basel-based material and aesthetic-geological "Earth Lab" that is linked to fieldwork excursions at sites marking the Anthropocene, and provides a venue for workshops and exhibition. Contemporary scholarly writings (2 collaborative peer-reviewed papers) are fused with discourse-oriented digital media (online platform, PDF and multimedia internet dispatches, Artistic Publication in an international distributed contemporary arts magazine, and digital Final Project Book) and artistic outputs (artefactual processual Earth Lab Exhibition at the Earth Lab). 'Shift Register' is the contemporary, impactful work of internationally-known artistic researchers and geological science specialists. The project hosts invitational workshops, invites online discussions and publicly presents research in its site of production. Through the project, we seek deeper understandings of the Anthropocene's construction, in avoidance of this new epoch further authorising destructive anthropocentrist modes of technoscience.

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[1] Davis, H. & Turpin, E. (2015). Art in the Anthropocene. London: Open Humanities Press. (p.64, 85)
[2] Haff, P., *et. al* (2015). Diachronous beginnings of the Anthropocene. The Anthropocene Review, 2(1), 33-58.
[3] "Geotrauma" is developed by Deleuze and Guattari, extended by R. Brassier and R. Negarestani (Woodard, B. (2013). On an Ungrounded Earth: Towards a New Geophilosophy. punctum books.) and relates to 'eco-aesthetics' via eg. M. Serres (Miles, M. (2014). Eco-Aesthetics: Art, Literature and Architecture in a Period of Climate Change. Bloomsbury Academic.).

2. Research Plan

Artistic research and practice and geoscience methods meet in 'Shift Register' via DIY and citizen science media-technologies and techniques, shifting the distant globality of Anthropocenic registers towards sensible, aesthetic regimes. Artistic-researchers here collaborate with researcher Christoph Kueffer, Co-director of the SAGUF Environmental Humanities Switzerland group, that looks at "feedbacks between changing climates and evolving human behaviors and worldviews in response to such change."[4] 'Shift Register' inserts itself into one of today's most hotly debated topic areas incisively, using innovative, experimental anti-disciplinary[5] methods: the Anthropocene is critically examined as a cultural and techno-scientifically produced mediation. Implication of related fields is intended: artistic research is central, and Science and Technology Studies[6] (STS) are extended toward a "positive anthropology"[7] as practice of (re-)aestheticising the ontological theatre of scientific factuality. Also related are 'media materialism'[8] and 'media ecology' discourses, but *grounded*—i.e.: recognised as geologically produced (coming from the Earth) and productive (communicating the Earth 'to us'). These topic areas align with the writings of fieldwork-oriented Land Art practitioners and critics (e.g: Smithson[9], Beuys[10] and The Center for Land Use Interpretation[11]); performed, shared knowledge production and citizen and DIY science motivations that 'open up' the 'blackbox' of scientific epistemology via aesthetic work. At stake is a description of material-semiotic actors,[12] the promise of a 'new kind of science' (Haraway, Barad[13]) and new knowledge-oriented materialist media theory (Kittler, Schrimshaw[14]). 'Shift Register' eschews 'art-science' framings that too-often result in science-illustration and communication projects that are uncritical and thus un-transformative in the perfunctory *use* of scientific outputs or canned representational forms. Avoiding hierarchisations of 'science/art' and 'experts/amateurs', we assure that artist-researchers *directly practice* scientific investigations, transforming context and experiment "against method."[15] Artistic research-practice is here a productive anthropology of science, via the development and use of DIY media-technical methods and instruments, giving the more open systems and aesthetics (*aisthesis*, sensorially engaged) of a *convivial*[16] technoscience of AMs. 'Shift Register' addresses a research that steps outside of the dual, polarised ecological narratives of salvation and catastrophe, addressing the ambiguous media-technological inscription and engorging of the planet marked by AMs. What is it to know the Earth again, through our senses, through science? Scientific practices are shown as ultimately aesthetically poetic.

[4]Kueffer, C. et. al. (2014). Developing the Environmental Humanities: a Swiss perspective. Science and Society, 23(1).
[5]STS scholar A. Pickering gives "anti-disciplinary" work as enacted outwith of convenient categories of art and science. (Pickering, A. (2008). Emergence and synthesis: Science studies, cybernetics and antidisciplinarity. Technoetic Arts, 6(2))
[6]Jasanoff, S., et, al (Eds.). (2001). Handbook of Science and Technology Studies. Sage Publications.
[7]Zielinski notes "special frictions between the arts, sciences, and technologies [giving an] anthropology seeks to keep open the possibilities of being active for the time to come." (Zielinski, S. (2013). …after the Media: Univocal.)
[8]Parikka, J. (2012). New materialism as media theory. Communication & Critical/Cultural Studies, 9(1), 95-100.
[9]Smithson, R., & Flam, J. D. (1996). Robert Smithson, the collected writings. Univ of California Press.
[10]Beuys, J., & Kuoni, C. (1993). Joseph Beuys in America: Energy Plan for the Western Man. Four Walls Eight Windows.
[11]Herman, D. (2004). The Center for Land Use Interpretation. ARTFORUM, 42(5), 39-41.
[12]Meyer, M. "Amateurization and re-materialization in biology - Opening Up Scientific Equipment," Knowing New Biotechnologies: Social Aspects of Technological Convergence, 2015.
[13] Barad, K. (2007). Meeting the Universe Halfway. Duke University Press.
[14]Kittler, F. A. (1999). Gramophone, Film, Typewriter. Stanford Press; Schrimshaw, W. (2015). Ur-writings. Leonardo.
[15]Feyerabend, P. (1993). Against method. Verso.
[16]Illich, I. (1973). Tools for conviviality. Perennial Library, Harper and Row, New York.

2.1. Current state of research in the field

The Anthropocene, a concept originating in the 19th Century[17] proposes a geological epoch marking shifts toward "earth magnitude" thinking, actions, actants, effects, relations and phenomena.[18] The Earth is a different Earth and we are remade as Earth's sovereign biopower, conditioned by "Big History"[19] and "Deep Time."[20] Technologies actively instrument and link newly-geological subjectivity as they reconstitute the Earth. Geologic/graphic landscapes fuse with media-technical territories as an active, productive, reflexive Earth-media and media-earth global experiment. The 'infosphere' touches down via the 'technosphere,'[21] a meshwork that simultaneously traumatises the Earth, while vascularising our intimate awarenesses of distant spatial, deep temporal and massive-scale agencies and exigencies. The Anthropocene and its markers result from capacities to (tele)communicate with such agencies, to read geological archives as material testaments, as signals from the past.[22] This ambiguous media-technical relation is the ground for all knowledge of Anthropocenic change: technoscientific proliferation creates global-human intimacies, while providing an authorising distance furthering media-Earth disturbances and manipulations. Ontological generosity is newly required as human and nonhuman activities are ever increasingly intertwined. The term 'environment' becomes less and less useful a word describing a relation in which we are *of* the environment not *in* it, not *on* the Earth, but *with* it.

Although contentious, the Anthropocene debate now cuts well across disciplinary boundaries: it has *arrived* as an integrating concept,[23] as "global change is more than climate change."[24] AMs are a kernel for perspectival critiques of speciesist and presumptuous analytics that are latently inimical or oppositional to actions required in our post-environmental age.[25] Current competitions and contestations between traditional and disciplinarian sciences scramble towards 'owning' AM determination definitively.[26] 'Shift Register' proposes, through textual, material and aesthetic practices, activities emphasising 'cultural' viewpoints on AM nomination that do not ignore geophysical, scientific and stratigraphic 'Golden Spike'[27] discussions.

Current propositions for anthropocenic start dates propose time-place declaratives of our superciliousness, propositions, played out within the knowledge-power politics of University departments, national governments and continental unions.[28] Convened as the Anthropocene Working Group (Subcommission on Quaternary Stratigraphy of the International Commission on Stratigraphy), a group of geoscientists is currently evaluating Anthropocene evidence to be entered in the International Chronostratigraphic Chart, as irreversible geological strata-signals that are

[17]Steffen, W., Grinevald, J., Crutzen, P., & McNeill, J. (2011). The Anthropocene: conceptual and historical perspectives. Philosophical Transactions of the Royal Society of London: Mathematical, Physical & Engineering Sciences, 369, 842-867.
[18]Douglas Kahn's 'earth magnitude' concerns artistic and media-technological gestures by humans interested to probe, approach or manipulate planetary finitude (Kahn, D. (2013). Earth sound earth signal. Univ of California Press.)
[19]'Big History' describes emerging, interdisciplinary academic disciplines whose analysis of the past does not begin with 'the human', taking instead a broad evolutionary and energetic approaches. Harvard Astrophysicist Eric Chaisson's 'cosmic evolution' and David Christian (see "Big History: Between Nothing and Everything" 2013).
[20]A term influentially brought to media studies and arts by Siegfried Zielinski, alongside other Media Archaeological terms.
[21]Both Peter Sloterdijk and Jean Luc Nancy emphasize the effect of the industrial revolution on the precipitation of Anthropocenic change, and a critique of the mythic teleology of technological change.
[22]Communications theorist J. D. Peters suggests such a media materia (signaletic) conception of the past in "History as a Communication Problem" Sydney Ideas Forum. Australia. Jul. 2010.
[23]Steffen, W., Grinevald, J., Crutzen, P., and McNeill, J., 2011, The Anthropocene: conceptual and historical perspectives: Philosophical Transactions of the Royal Society, v. 369.
[24]Steffen, W. et. al (2006). Global change and the earth system. Springer Science & Business Media. p. 2
[25]Malm, A., & Hornborg, A. (2014). A critique of the Anthropocene narrative. The Anthropocene Review, 205301961351629.
[26]Zalasiewicz, J. (2015). Epochs: Disputed start dates for Anthropocene. Nature, 520(7548), 436-436. Chicago.
[27]Global Boundary Stratotype Section and Point, or GSSPs, are physical geolocators of epochal changes inscribed into earth physiology and/or chemistry, and often marked with gold spikes driven into the Earth.
[28]See, Zalasiewicz, et. al, *The Anthropocene Review: Its significance, implications and the rationale for a new transdisciplinary journal.* The Anthropocene Review, 1(1), 3-7, 2014;

"large, clear and distinctive."[29] Should the Anthropocene be formalized and in what way?[30]; and how might a singular, universal, and eternal registration mark it? Distinctions between the Anthropocene and prior epochs are here grouped into three main intervals: *The Early Anthropocene,* marked by the transition from nomadic to agricultural societies and transoceanic genocidal invasions; *The Industrial Anthropocene* pointing to the early 1800s when the invention of Watt's steam engine set a course towards the global-overcoming of photosynthetic energy barriers; and markers linked to explosive post-war populations and industrial activity termed *The Great Acceleration*[31]:

PROPOSED AM INTERVAL #1: The Early Anthropocene. Here AMs correspond to landscape effects precipitated by transitions from nomadic to agricultural human livelihoods, correlating to biological perturbations (e.g.: mass animal extinctions over a few centuries). Expansions and population explosions were caused by agricultural and seafaring techniques, and the human-directed evolution of other species. Included in 'Early Anthropocene' AM proposals are the dates 1492 and 1610,[32] coextensive with colonial exchanges between the Americas and Europe, and the slaughter of indigenous Peoples; land use changes are registered in planetary chemistry.[33] Techniques and locales for sampling the Early Anthropocene are:

- Tree-Ring and biomass growth measurements, carbon concentration analysis, detection of exchanges of indicator gases. Measurements are done at field sites such as the SMEAR 2 field station, Hyytiälä, Finland[34]
- Comparative air quality tests provide measurements of Early Anthropocene data, which can be made all over the globe.
- Longitudinal sunlight and ozone techniques use pyranometric ('light measurement') methods (e.g.: Dobson Spectrometry, electronic sensing, signal, image and satellite data) to determine atmospheric changes globally.

PROPOSED AM INTERVAL #2: The Industrial Anthropocene. The Anthropocene onset proposal spurring current interest and debates links the epoch's beginnings to Industrial Revolution activities, including the invention of Watt's steam engine (1784).[35] Lovelock proposes that the Anthropocene be dated slightly earlier, at the introduction of the Newcomen engine (1712).[36] Such claims hinge on relative energetic measurements that mark points where individuals and groups of humans greatly amplified their energy-footprint, starting in the late 18th Century. Registration techniques and locations allowing for Industrial Anthropocene AM determinations are:

- Soil forensics and the compilation of technofossil[37] records expose early industrial histories. Mass-constructions of urban centers, and mass-production of industrial artefacts uncover archaeological techniques that correlate globally following post-war mass manufacturing and waste accumulation explosions.[38] Sites like the Ruhrgebiet region in Germany (steel coking) are rife with Industrial AM determiners.

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[29]Outlined on the Anthropocene Working Group's mission statement (quaternary.stratigraphy.org/workinggroups/)
[30]Holocene/Anthropocene epochs merger has been tabled, providing a non-anthropocentric justification based in 'natural' processes. (Certini, G., & Scalenghe, R. (2015). Holocene as Anthropocene. Science (New York, NY), 349(6245), 246.)
[31]As defined, for example, by the International Geosphere-Biosphere Programme (IGBP, a body formed in 1987 to "coordinate international research on global-scale and regional-scale interactions between Earth's biological, chemical and physical processes and their interactions with human systems." (igbp.net)
[32]The 1610 minima of CO_2 known as the 'Orbis Spike' where disease and population loss causes revegetation of previously cultivated land. (Simon L. Lewis & Mark A. Maslin (2015) "Defining the Anthropocene", Nature. March.)
[33]Smith, B. D., & Zeder, M. A. (2013). The onset of the Anthropocene. Anthropocene, 4, 8-13.
[34]The Hyytiälä field station SMEAR II is an atmosphere-vegetation-soil monitoring station, run as a co-operation of the Division of Atmospheric Sciences and Department of Forest Ecology at the University of Helsinki. It cooperates on ecosystem-atmosphere relation research, as part of the Research Unit on Atmospheric Composition and Climate Change, a Center of Excellency of the Academy of Finland, and Nordic Center of Excellence.
[35]Crutzen, P. J. (2002). Geology of mankind. Nature, 415(6867), 23-23.
[36]Lovelock, J. (2014). A rough ride to the future. Penguin UK. p. 87.
[37]Zalasiewicz, J., Haff, P., et. al (2014). The technofossil record of humans. The Anthropocene Review, 205301961351495.
[38]Erlandson, J. M., & Braje, T. J. (2013). Archeology and the Anthropocene. Anthropocene, 4, 1-7.

- Geographical, topological and subterranean studies of terraforming, geoengineering and mining practices (image archives, photography, elevation and satellite-GIS studies) in areas like Saarland (e.g.: Völklingen Ironworks) and North Rhine-Westphalia (coal mining) in Germany reveal irreversible landscape deformations.

Proposed AM Interval #3: The Great Acceleration. The most recent of proposed AMs stem from sharp rises in human population growth and 'productivity' following WWII. From 1945 there is a defined increase in CO2, agricultural and industrial production, petrochemical extraction and consumption, and urbanism. This interval brings links to the initial realities of 'petrocapitalism,'[39] the speedy release of a "bloated payload of geologic force, courtesy of fossil fuels,"[40] producing numerous salient AMs. This interval is paralleled by the rise of the nuclear age; nuclear tests, power station waste and leakage from the mid-20th Century have scattered artificial radionuclides across the globe, leaving readily detectable signatures in strata. Measurements of 'Great Acceleration' AMs are:

- Chemical signalling in terrestrial, marine and ice substrates give petroleum and polyaromatic hydrocarbons, and polychlorinated biphenyls. The monogorod of Neft Daşları (Baku, Azerbaijan) is a site of intensified petroleum extraction—built in 1945 it is the world's first offshore oil platform, 1100m under the Caspian Sea.
- Analyses of spheroidal carbonaceous particles, as signature black carbon associated with the burning of fossil fuels (in terrestrial/marine sediments and ice cores worldwide) show rapid rises in the mid-20th Century.[41] Sampling occurs globally with field and lab techniques: particle separation, smear slides and magnetometry.
- Soil, rocks and flora can be examined for artificial radionuclide signals. A proposed GSSP in 1964, dubbed the "Bomb Spike" marks peak radionuclide fallout.[42] Measurements are localised at sites such as the Trinity testing facility (White Sands Missile Range, New Mexico).

For each proposed determination of onset, we must critically evaluate AMs as scientific-cultural fact. 'Shift Register' renders their production visible and sensible, beyond AM *selection* towards an unmonumental media-thinking that asks what a truly *anthropocenic*, *geo-subjective*, *nonhuman* 'marker' should be: multiple not singular? mutable and indeterministic? contingent not static? A 'Golden Spike' for our age is at best an evidential constellation—a confrontation with the "bloody edge of the Anthropocene"[43]—not celebrating human calamity, but marking the exhaustion of modernity's technoscientific conceits.

The contributions that artistic research makes to complex knowledge domains in extending epistemological and perspectival diversity is by now uncontentious.[44] Bringing aesthetic, material, and more openly public engagements to the always-interpretive ambiguity of sense data, media artefacts and methodological assumption, media-technological artistic research-practices in particular allow for rigorous, original and accessible counterpoints to scientific sovereignty. Contemporary artistic-research extends experimental practice towards intervention and direct, sustained involvement in transdisciplinary topics, through anti- and extra-disciplinary[45] research signposted by artist-technologist researchers like Nam June Paik, Max Bense and Hans Haacke, who took media and communications

[39]LeMenager, S. (2012). The aesthetics of petroleum, after oil!. American Literary History, ajr057.
[40]Yusoff, K. (2015). Anthropogenesis: Origins and Endings in the Anthropocene. Theory, Culture & Society, April.
[41]Swindles, G. *et. al.*, "Spheroidal carbonaceous particles are defining stratigraphic marker for the Anthropocene," Nature, May 2015 (nature.com)
[42]A nuclear testing ban, beginning in 1964, sharply reduced radionuclide production, giving the proposed GSSP. Simon L., et. al. (2015), A transparent framework for defining the Anthropocene Epoch, The Anthropocene Review, May.
[43]Bratton, B. (2014) "Notes on Extinction, Emergence and Biochemical Design. (extinct.ly)
[44]Eg.: Russegger, G. *Coded Cultures*, 2011. Springer Vienna; and Schwab, M. *Experimental systems: future knowledge in artistic research*, 2014.
[45]Brian Holmes takes Pickering's anti-disciplinarian suggestions into artistic practice via its characterisation as 'extra-disciplinary' art practice as investigations of modernist institutions. (Holmes, B (2007) Extradisciplinary Investigations. Towards a New Critique of Institutions. European Institute for Progressive Cultural Policies. eipcp.net/transversal).

as central to engaging wider, transdisciplinary expert groups and diverse publics. Through the contemporary curatorial-research projects of Bruno Latour,[46] Peter Weibel,[47] Nicolas Bourriaud[48] and Anselm Franke,[49] and related work at Critical Media Lab Basel,[50] supportive and sustained research practices integrating anthropocenic science and eco-aesthetics are underway.

Cross-cutting, productively-peripatetic, open artistic research complements the definitional activity of Anthropocene-dating, as a complex and agonistic scientific and historical topic of relevance to broad audiences and actors (human and nonhuman beings).[51] 'Environmental Humanities' (EH) likewise amalgamates methodological, epistemological, academic-professional and material-environmental concerns. Geoscience invested artist-research, practice-based EH, is well poised to fundamental challenges posed by ecological novelty: "distinguishing between nature and culture as separate realms of scientific investigation becomes obsolete; and understanding how ecological systems change requires embracing the complexities of ecosystems under real-world conditions (as opposed to controlled experimental settings) resulting from open system boundaries, contingencies and historicity."[52]

The Anthropocene is "primarily an aesthetic event," as Davis and Turpic write in their 2015 book *Art in the Anthropocene*. One of the key challenges of a changing world that continually reconfigures sensation and requires massive scale shifts (local-global, regional-planetary, individual-collective) is the devising of strategies that relate the conditions for the possibility of modern aesthetic-epistemic tropes, of contemporary technoscientific lifeworlds. Needed today are counter-representational, alternative aesthetics enacting descriptive and elucidatory 'experimental metaphysics' of knowing, as necessary and complementary turns towards empiricism. All knowledge is mediatised and prosthetic, a condition shown most emphatically when we attempt to transduce the complex agencies of hyperobjects like 'Earth.'[53] These agencies are only brought into awareness via the register-shifting of the combined aesthetic effects of technological capture and the affects of technical networks. From soil sampling to carbon dating, the Earth and its '-spheres' are rendered to experience by media. Artistic research and practice as media-technical, aesthetic-epistemic pursuits of the artist-scholar have never been more essential than in the Anthropocene. Practice and research through the arts speculates toward embodied, sensory relations to what are otherwise extra-phenomenal, planetary scale agencies; rationally unfathomable or beyond our capacity to sense, feel and so think. These are the scales of a globally reconstituted, geological subjectivity and milieu, for which new relational strategies need to be developed toward always-provisional, new understandings of shifting, geologically-grounded and re-constituted human[54] and nonhuman[55] relations. These complexities are what necessitate an artistic-research response, leveraging the expertise of science, as well as the non-expert conviviality of contemporary media-technics, the tools and knowhow of our contemporary, post-digital age.[56]

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[46]The upcoming "Reset Modernity!" at the ZKM Center for Art and Media Karlsruhe (2016).
[47]"GLOBAL: InfoSphere" programme at the Center for Art and Media Karlsruhe (2015).
[48]"The Great Acceleration: Art in the Anthropocene" at the 9th Taipei Biennial (2014).
[49]The Anthropocene Observatory projects at the Haus der Kulturen der Welt in 2014 and 2015.
[50]F. Caviezel's Critical Media Lab Basel-based project on purification, treatment, disposal. (ixdm.ch/portfolio/times-waste).
[51]Alonso, C.(2015). Artistic Practices, Discursive Contexts & Environmental Humanities in the Anthropocene. Artnodes (15).
[52]Kueffer, C.(2015). Ecological novelty: towards an interdisciplinary understanding of ecological change in the Anthropocene. In Grounding Global Climate Change (pp. 19-37). Springer Netherlands.
[53]Tim Morton describes hyperobjects as "entities of such vast temporal and spatial dimensions that they defeat traditional ideas about what a thing is in the first place" in *Hyperobjects: Philosophy and Ecology After the End of the World*, 2013.
[54]Daniel Lord Smail charts the material co-development and co-respondence between geology, environment, evolutionary biology and neurocience (On Deep History and the Brain, 2007).
[55]Jane Bennett understands our co-relative responsibility to nonhuman agencies which also compose the earth and world. (Vibrant Matter: A Political Ecology of Things, 2009)
[56]The condition in which digital tools and technologies become normalised and unnoticed, invoking current artistic tendencies toward messy, electrical and physical digital media practices (Cramer, F. (2015). What Is Post Digital. Postdigital Aesthetics: Art, Computation and Design. Basingstoke: Palgrave Macmillan)

The work of primary Earth artist, writer and researcher Robert Smithson provides clear models for a unmonumentalised art of the Anthropocene, exemplified through his notion of 'non-site'[57]—precisely the marking of 'questionable monuments' to specific geological materialities and ecologies. Smithson's geological archives are as constructed by their representations in media and language as they are mineral and material. His is a language that is quotidian and pedestrian,[58] in contrast with the terms of imposed permanence of categorical, classical geology. The Anthropocene's strata are not fixed or determined but open to sliding interpretations as 'naturecultures'[59] that are worked, reworked and upturned by Earth process and human industry. Smithson's art gives us 'Earth as media' to be endlessly decoded and 'Earth as mediated' via collaboration with media and infrastructural interventions.[60] Although Land Art and planetary and interstellar media-aesthetic practices (wherein the Earth also *becomes media*) are most often associated with eco-philosophical and pastoral environmental sustainability movements, at times Smithson's work (*Spiral Hill*) assumes a monumental character, reinforcing narratives of human mastery over geology: art can be just as insensitive to 'monumentalising' problematics as can technoscience. Joseph Beuys' geologies of communication apparatuses (*Das Erdtelephon*, a 1968 rotary telephone connected to a lump of clay) examples how an artistic object can crystalise the geo-importance of the everyday: media-technical access points, simultaneously intimate and remote, that precipitate anthropogenic agencies and anthropocenic productions. Beuys' social-sculptural and eco-aesthetic work (*7000 Oaks*) is proto-Anthropocenic artistic-research, ethical-aesthetic materialism later addressed by Gustav Metzger at the "Facing Extinction" conference (7 June 2014): "The art, architecture and design world needs to take a stand against the ongoing erasure of species—even where there is little chance of ultimate success. It is our privilege and our duty to be at the forefront of the struggle. There is no choice but to follow the path of ethics into aesthetics." It is a path that extends approaches inaugurated by actors like Beuys, Haacke and the Artist's Placement Group, towards contemporary cutting edge artistic research, visual anthropology and sensory ethnography.[61] Brought closer to technoscientific pursuits, these strands metastasize into a kind of positive and interventional Science Technology Studies *in action* and *in the wild*, questioning and enacting the production of 'matters of fact.'

Artistic, aesthetic and material activities addressing anthropocenic topics have grown in number over the past five years, forging an operative contemporary community of researchers, artists and practitioners. As yet under-represented in Switzerland, there exists ample opportunity for linked involvement to ongoing international programmes and activities, such as Haus der Kulturen der Welt and Max Planck Insitute's programme of scientific, artistic and cultural encounters and outputs in Germany ("Anthropocene Curriculum"); Bruno Latour's grounded Athropocene interdisciplinarity "Sciences Po Programme d'expérimentation Arts et Politique" or SPEAP in France (sciences-po.fr/speap); the 'geological turn' in contemporary ideas, architecture, design, and aesthetic work in part heralded by Ellsworth and Kruse with the art-humanities "Making the Geologic Now" projects; and upcoming anthropology, philosophy and sociology-centred Anthropocene Conference hosted by the College de France and the Sorbonne in Paris (11/2015). (The 'Shift Register' project has developed relationships with each of these projects—see attached letters of support from relevant organisations.)

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[57] Smithson's concept of non-site references the difficulty of 'representing' actual sites abstractly.

[58] "The strata of the Earth is a jumbled museum. Embedded in the sediment is a text that contains limits and boundaries which evade the rational order, and social structures which confine art." Robert Smithson, A Sedimentation of the Mind: Earth Projects." (originally published in Artforum, September 1968)

[59] Haraway's term describing the materialist entanglement of nature and culture, bodies and minds, matter and semioticity. (Haraway, D. J. (2003). The companion species manifesto. Chicago: Prickly Paradigm Press.)

[60] In a 1972 letter to Allen Overton Jr., president of the American Mining Congress, Smithson declared unabashedly: "I am developing an art consciousness for today free from nostalgia and rooted in the processes of actual production and reclamation.... Industry cannot afford to view my kind of art as a luxury, but rather needs to view it as a necessary resource. A dialogue between earth art and mining operations could lead to a whole new consciousness." (geologicnow.com)

[61] Pink, S., Et. al (2010). Walking across disciplines: from ethnography to arts practice. Visual Studies, 25(1), 1-7.

The "Anthropocene Monument" exhibition project at Toulouse developed the idea of a memorial to modernist sublimity[62]—a 'final blowout' documenting and illustrating collective anthro-effects. Presented there were grand artistic versionings—materials collections, large-scale print images and projections, awe-striking sculptural installations, and rapturous digital data-visualisations. While the projects encouragingly addressed geoaesthetics, geosubjectivity and geotrauma from aesthetic perspectives, few addressed a necessary dissipation of 'monuments,' as ambivalent representations of AMs. 'Shift Register' intends to trace the activities of Anthropocenic production back to their sites of evidential production as mediated fact, not as presumed causal origin or to sublimely invoke a global-guilt. Responsive and responsible arts of the Anthropocene need to push beyond the modernist technoaesthetics of stultifying amazement, and the eco-pastoral sentiment of memorialisation, toward its opposite: 'unmonumentalisating' AMs and "declining the invitation" of the Anthropocene, as Dipesh Chakrabarty has done.[63] A 'critical media' approach to the material-semanticity of geoscience in the Critical Zone,[64] and its re-production as "the Anthropocene" produces an artistic research practice that results in conceptual and presentational schemas not marred by illustrative sublimity, dissociative spectacle, and the shallow engagements that perennially reaffirm presumptuous mastery of the globe.

Few artistic research projects address the Anthropocene experientially through it's localised, physical materiality, through the methodological assumptions and situated productions behind geoscientific 'facts.' The critical ambiguity of the idea of anthropocenic epochal novelty carries with it contradictory and all-too-human aspects glossed over by aesthetic formalism.[65] AMs are at once the ignoble evidence of immoderate exploitation, and strangely useful for chronological and evolutionary science, as referents of and for technoscience.[66] Artistic-research and exhibition work in relevant domains, tends toward the industrial sublime of materials extraction and manufacturing (e.g.: Edward Burtynsky, Vincent Laforet), or towards the techno-aesthetics of awe wrought by presentations of global data networks (e.g.: Globaia.org's New World Anthroposphere, or Autogena & Portway's *Black Shoals* artificial planetarium projection linked to the real time dynamics of the stock market). In contradistinction to tendencies to concretise AMs as static objects in the secured place of a museum (in a way analogous to what happens in a scientific lab or stratigraphic commission), we shift standardized, objectified AMs into a relatable aesthetics of practice, in-process and composed by us and for us. 'Shift Register' also takes art to be originarily geological, in relation with archaic 'rock art' and contemporary 'land art', as direct forms of geologic engagement. 'Art and technology' most specifically has profitably undergone a 'geological turn' of late, situating the techno- and info-spheres with the geopolitical *processing* of sourced mineralogy, mining and manufacturing.[67]

'Shift Register' project activities are linked to extra-disciplinary artistic research such as that of UK artist-research group Unknown Fields, who work to 'unmake' media-technical devices, linking them to Earth sources (unknownfieldsdivision.com). "Rare Earthenware" is a piece exampling an expanded artistic-research practice that is in parts ethnography, anthropology, investigative reporting (in collaboration with the BBC[68]), geologic field-sample collection and the making of aesthetic objects. The project results in ceramic vases patterned after Ming designs, but

[62]See lesabattoirs.org/expositions/anthropocene-monument
[63]Chakrabarty, D. (2014) [Lecture] An Opening, Anthropocene Project, HKW. (hkw.de/de/programm/projekte/veranstaltung/)
[64]Earth's Critical Zone is the "heterogeneous, near surface environment in which complex interactions involving rock, soil, water, air, and living organisms… determine the availability of life-sustaining resources" (U.S. NRC, 2001)
[65]Nixon, R. "The Anthropocene: The Promise and Pitfalls of an Epochal Idea," Edge Effects (6 November 2014)
[66]The proposed AM of July 16th 1945 at Trinity, New Mexico gives useful chemo-stratigraphic datums now used to date everything from atmospheric changes to the age of living cells (Andrew Revkin, "Researchers Propose Earth's 'Anthropocene' Age of Humans Began With Fallout and Plastics" in the New York Times, 2015).
[67] Art-activist and DIY software group Molleindustria produced 'Phone Story', a mobile phone application addressing the warlord-operated mining, factory suicide, and product launch-day 'riots' surrounding mobile techno-culture (phonestory.org).
[68] A series of articles published online with the BBC entitled "The Worst Place on Earth," (2014-2015).

are made from the clays of a toxic 'tailings lake' (created by rare-earth mineral smelting for electronics production) in Baotou, China forming "a conveyor belt that stretches from Inner Mongolia to a London retail store."[69] Swiss artist Ursula Biemann's (www.geobodies.org) 2012 project "Egyptian Chemistry," including a video-documented performance of aestheticised laboratory work (trans-bottling of Nile River samples), is as well of note. Biemann's work re-performs the media-artistic and performative composition of anthropogenetic and anthropocenic 'fact.' "Teacup Tools" by Agnes Meyer-Brandis, winner of the 2015 Ars Electronica Award of Distinction, was created with Finland's SMEAR station (University of Helsinki), shows how planetary science can be *grounded* through accessible citizen and everyday aesthetics. Fondation Beyeler recently exhibited the eco-aesthetics of Olafur Eliasson, with the "Everybody owns the Sun" (2015) in which a cubic meter of frozen Rhein water (glacial at its outset) is left to melt in a museum.

The combined outputs of Howse, Kemp and Allen are themselves central to the take up of materialist and geological topics in 'art and technology.' Authored reflections and critical lauding ranges through academic and art critical writings: the Scan Journal of Media Arts Culture,[70] Neural.it[71], eContact! Journal for Electroacoustic Practices[72], and Mute Magazine.[73] Key works include Howse and Kemp's London and Berlin workshop and exhibition series "The Crystal World" (2012) as well as Allen's Haus der Kulturen der Welt commission "Critical Infrastructure."[74] Allen and Howse's "Pitch Drop" exhibition and publication project in Copenhagen (resulting in a journal special issue[75]) is amongst projects of reference in media-technological geological, anthropocenic and material ecological artistic work. These projects have all been described critically[76] and addressed in Parikka's recent (2015) field-defining book, *A Geology of Media*.[77]

Centrally, 'Shift Register' proposes a grounding of the reified, exalted sublimity of both the arts and sciences of the Anthropocene, bringing them down-to-earth, through investigation of their embodied production. The Anthropocene is always-already 'Do-It-Yourself,' as the proposition of this new epoch results from emergent and cumulative effects of the individual, local and regional actors of Earth's commons. It attempts to reconstitute a 'geocitizenry', broadening knowledge and aesthetics to Earth magnitude phenomena, effects and responsibilities. Vested in the ethics of collaborative practices, and overlaps between 'art and technology,' technology development and 'sustainable arts' communities of the late 90s resulted in a host of media-ecological work, both suggestively pragmatic and critically poetic.[78] These tendencies describe the genealogy of today's active, creative, publicly-minded research communities that ally Open Source and open-(black)box ethics with motivations toward 'civic technoscience'[79] and 'schoolyard seismology.'[80] New kinds of embodied aesthetic-scientific literacies (online) and localities (outside the art gallery) result. Identifiable techniques and toolsets[81] known to 'maker', 'hacker' and DIY technology artistic-research[82]

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[69]Young, L. Rare Earthenware (2013), unknownfieldsdivision.com.
[70]Whitelaw, M (2013). "Sheer Hardware: Material Computing in the Work of Martin Howse and Ralf Baecker." In Scan Journal of Media Arts Culture.*The In/Visibilities of Code.* 10(2).
[71]Ludovico, A (2014). "Critical Infrastructure". Neural.it critical digital culture and media arts. Neural.it.
[72]Howse, M. (2014) "Martin Howse."eContact! Journal for Electroacoustic Practices. (econtact.ca)
[73]Howse, M., Kemp, J.(2012) "The Crystal World". Mute Magazine. September. (metamute.org)
[74]Allen, J. "Critical Infrastructure", APRJA, 2015 (aprja.net). See also project site: criticalinfrastructure.cc.
[75]Special issue of the media-philosophy journal *continent.*, ""Pitch Drop", June 2015. continentcontinent.cc
[76]Parikka, J. (2015) "Earth Forces—Contemporary Land Arts, Technology and New Materialist Aesthetics." Cultural Studies Review volume 21 number 2 September. (epress.lib.uts.edu.au)
[77]Parikka, J. (2015). A Geology of Media. University of Minnesota Press.
[78]Eg.: Holmes, T. (2007, June). *Eco-visualization: combining art & technology to reduce energy consumption.* In Proceedings of the 6th ACM SIGCHI Creativity & Cognition (pp. 153-162). ACM; Kirschenbaum, M. (2008). *Mechanisms: New media & the forensic imagination.* Mit Press.; Allen, M. (1999). Do-it-yourself climate prediction. Nature, 401(6754).
[79]Wylie, S. A., Jalbert, K., Dosemagen, S., & Ratto, M. (2014). Institutions for civic technoscience: How critical making is transforming environmental research. The Information Society, 30(2).
[80]Husebye, E. *et. al* (2003). School yard seismology. Journal of Geoscience Education, 51(3).
[81]Specific toolsets include the 'Processing' programming language (processing.org), the Arduino Open Source hardware sensing platform (arduino.cc) and the Raspberry Pi Foundation's single board computing platform (raspberrypi.org).

provide approaches, support communities, venues, audiences and outputs channels for research re-framings of the already-aesthetic media-technical practices of Earth and climate science. 'Hacker' and 'maker' artist-researchers like Katie Paterson, Garnet Hertz and Trevor Paglen have turned interests in geo-politics and material-media toward topics of geology and earthly citizenship.[83]

Technological and computer-based media arts researchers, as a community centrally and perennially concerned with toolsets and their production, have enjoyed a productive alliance with DIY technology, Open Source and citizen science communities for more than half a century.[84] We recognise, as others have,[85] that the practices (*in situ* field-, laboratory and studio work), instruments (electronic, digital media[86]) and representations (graphical and data-derived[87]) of science are often very similar to the media-technical toolsets available to technological and computational arts practice. Electronic environmental sampling, testing, sensing and data aggregation methods[88] produce evidential traces that are rendered into multimedia representations: images, recordings, signals and databases. These composed representations underwrite AM markers and their determination amongst scientific and broader cultural communities. The overlapping practices of artists, DIY technology development, and citizen geoscience—sharing toolsets and methods in resonance with Open Source development[89]—invigorate the work proposed through 'Shift Register.' We create and document the sensible-aesthetic practices of scientific AM determination, bridging studio-lab (the "Earth Lab") environments with field sites, for their elaboration as media artefact, workshop, public exhibition, and research publication. The result is media-technological artistic research that is knowledge-oriented, critically productive, and interventionist. As such, 'Shift Register' is artistic research functioning in the mode of interventionist, proactive STS: 'Matters of fact' are here *rendered* 'matters of concern'[90] *with* and *for* the publics concerned with them.

[83]Feigelfeld, P. (2015) Media Archaeology Out of Nature: An Interview with Jussi Parikka. E-Flux. (e-flux.com)
[84]Edmonds, E. A., Weakley, A., Candy, L., Fell, M., Knott, R., & Pauletto, S. (2005). *The studio as laboratory: combining creative practice and digital technology research.* International Journal of Human-Computer Studies, 63(4), 452-481.
[85] Eg.: EU FP7 initiative 'Studiolab' (studiolabproject.eu) merged art studios with science labs, producing creative projects bridging science, art and design. Citizen and DIY science approaches are also central to media scholar J. Gabrys' 2015 European Research Council "Citizen Sense" project (citizensense.net).
[86]Hart, J. (2006). Environmental Sensor Networks: A revolution in the earth system science? Earth-Science Reviews, 78(3).
[87]Coleman, G., & Byrne, D. (2015). Experiential Ecologies: A Transdisciplinary Framework. Media Art & the Urban Environment (pp. 63-84). Springer Publishing.
[88]Such as the United Nations Environment Programme Environmental Data Explorer (geodata.grid.unep.ch).
[89] The Public Laboratory for Open Technology and Science (Public Lab) is an exemplary such community online that develops and applies open-source tools to environmental exploration and investigation.
[90] Latour, B. (2004). Has Critique Run Out of Steam? From matters of fact to matters of concern. Critical inquiry, 30(2).

2.2. Current state of our own research

The research team is composed of accomplished, influential and highly motivated artist-scholars with complementary interdisciplinary backgrounds, and experience in extra- and inter-disciplinary research. We are each part of transdisciplinary art, technology and media research communities actively engaging the *simultaneity* of scholarly and aesthetic practices. As artist-researchers and theorist-practitioners brought together at the Academy of Art and Design FHNW, Institute of Experimental Design and Media Cultures (IXDM) Critical Media Lab, we benefit from a world-class media lab facility, and an international hub for "critical media" practice-as-research.

The Critical Media Lab develops pioneering methods and research, having received numerous national awards (SNF) and enabling high profile international collaborations. The rejuvenated facility at the Academy of Art and Design FHNW is systematically supported by technologies and technological support personnel. A leading group of media art, design and artistic-researchers provide tacit guidance and support of all projects (SNF-funded researchers Shintaro Miyazaki, Johannes Bruder, Moritz Greiner Petter). Trans-disciplinary activities at the Critical Media Lab extend the tradition of critique, advancing practical, experiential and experimental research and production. The research team for 'Shift Register' comprises Jamie Allen (PhD), Martin Howse (BA Goldsmiths UK), Jonathan Kemp (PhD), Christoph Kueffer (Phd, PD Dr.) and Claudia Mareis (Prof. Dr.).

Jamie Allen (main applicant) is Senior Researcher at the Critical Media Lab, with over 15 years of experience in art and technology research contexts. His interests and track record span written publications (MIT-Leonardo, ACM Journal, essays for academic and popular press), public talks and lectures, teaching and exhibitions at the interstices of art, design and technology. Allen's current research deals with material-cultural relations afforded by media technologies through infrastructures. This project develops Allen's infrastructure studies of media, as the deep-infrastructure of media-geology and earth-media. Allen brings to the project knowledge as a designer, design-ethnographer, media artist, writer and theorist. He is also an electrical engineer and software developer. Allen's senior-level management of prior large-scale research projects for National (UK, Denmark) and European Framework (PELARS, MeLA), ensure coherency, and high-quality impacts and outputs.

Claudia Mareis (co-applicant) is a Swiss designer, design researcher and cultural scientist. Since 2013 she is director of the Institute of Experimental Design and Media Cultures at the Academy of Art and Design FHNW. There she is also the founder of the Critical Media Lab Basel, opened in 2014. She completed her Ph.D. on "Design as Epistemic Culture" at the University of Arts and Industrial Design Linz in 2010. Over the last years she has been lecturing and researching internationally at various institutions, including the Max Planck Institute (2009), Zurich University of the Arts (2011–13), Humboldt University (2011), Massachusetts Institute of Technology (2012) and Vilnius Academy of Arts (2014). Her research is on historical design epistemology; between design, media and STS.

Martin Howse is an artist-researcher working across media at the intersection of art, science and technology, on practical knowledge sharing and 'un-blackboxing' methodologies. He has initiated several DIY and free-software projects, and held workshops in established venues worldwide, including a recent series in Finland exploring the materiality of radioactive phenomena. His explorations of environmental data and code was awarded the VIDA 1st prize in 2005. His experimental performances of public art-science research, and related reflexive writings[91] and critical elaboration[92] are taught in numerous postgraduate media art syllabi. Howse's international repute is shown by his recent invited keynote for the high-profile artistic-research conference Energies in the Arts, at MCA and UNSW Art

[91] Howse, M., Kemp, J. (2014) Stack, Frame, Heap. In Plants, Androids and Operators–A Post-Media Handbook (p.158-168). London: Mute Books.; Howse, M. (2006). "XXXXX". Mute Books, ISBN 0955066441.
[92] Schrimshaw, W. C. (2012). Undermining Media. Artnodes, (12).

& Design, Sydney, 2015. Keystone activities include a commissioned masterclass for the "The Geologic Imagination" Sonic Acts 2015 Festival in Amsterdam, and an ARTE television online documentary feature.[93] 'Shift Register' provides Howse an opportunity to engage with an academic research environment, as knowledge exchange and dissemination in networks in Swiss and Germanic Europe.

Jonathan Kemp is an artist-researcher with vast experience organising projects designed to interrogate the practical and theoretical settings of technology based art. For critical writings on his open-laboratories and exhibitions "The Crystal World" (2012) work, Kemp was awarded his Ph.D. (2013), and this project has been examined in critical literature.[94] The "Stack, Frame, Heap" (2014) artistic-research residency at the Post Media Lab, University of Leuphana, Germany created plant-silicon using soil mediums made from pulverised computer circuits. Kemp writes for the media-politics journal Mute, and numerous other publications.[95] He is a senior conservator with published articles and chapters on cultural heritage worldwide,[96] is consultant editor of Springer's Bulletin of Engineering Geology and the Environment and has done fieldwork at UNESCO World Heritage Sites in Iran and Brazil. 'Shift Register' is a valuable opportunity for Kemp to engage with artistic-research as fieldwork practice, bringing expert level knowledge to Switzerland and seeding new orientations of his own work.

Prof. Dr. Christoph Kueffer is a trained environmental scientist (at ETH Zurich; with specialisation in environmental physics) and now a senior scientist at the Institute of Integrative Biology, Department of Environmental Systems Science at ETH Zurich and a Professor for Urban Ecology at the Landscape Architecture Department of the University of Applied Sciences Eastern Switzerland (HSR Rapperswil), with years of transdisciplinary research experience; as a fellow of Collegium Helveticum (a Zurich-based Center of Science and Technology Studies) and the Center for Interdisciplinary Research (ZiF) at Bielefeld University (a leading European Center of Advanced Studies), and as a founding member of Environmental Humanities Switzerland. His own work focuses on the ecology of the Anthropocene, and more specifically on novel ecosystems and their management, socio-ecological regime shifts, climate change impacts on vegetation, biodiversity conservation in highly modified anthropogenic ecosystems, and invasive species. Kueffer coined the term "ecological novelty" as a basis for a more interdisciplinary understanding of what constitutes ecological change in the Anthropocene. His work (0.5 days per week) on 'Shift Register' will be as a valued geoscientific expert, and scientific community liaison.

[93]ARTE (2014) "The Earth is My Motherboard" (creative.arte.tv/de/episode/martin-howse-die-erde-ist-mein-motherboard).
[94]Fuller, M. (2012), *The Garden of Earthly Delights*, Mute Magazine; Myers, R. (2012),*The Crystal World: Algorithms, Inhuman Speed and Complexity*, Furtherfield.
[95]Including: Kemp, J. Chapter: *The Crystal World* in, Experiencing the Unconventional: Science in Art, eds. Adamatzky, A and Schulbert, T. World Scientific., 2015; Howse, M., Kemp, J., *Stack, Frame, Heap*, in Plants, Androids, and Operators - A Post Media Handbook , PostMediaLab/Mute 2015; Kemp, J. *Pedunculated Fandango*, Mute , 2014; Saiz, M. *101 Excuses to make Art*, ed. J Kemp, Decreated , 2009.
[96]Kemp, J. (2006) *Marble,* in 'Stone Conservation: Principles and Practice', Routledge.

2.3. Detailed Research Plan

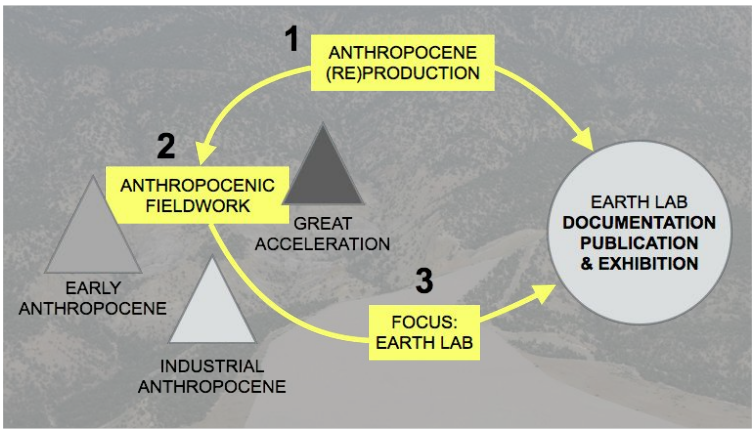

Fig. 1 — Schematic summary of Shift Register project research streams and .

The technoscientific complex, wherein scientists are purported to study only 'data', now acts as sole spokesperson for the Earth, the sole domain from which admissible 'knowledge' emerges.[97] Shifting the registers of AMs toward visible and sensible regimes is achieved through artistic-aesthetic, DIY and citizen science media-technologies methods. Intervention here destabilises Anthropocenic 'fact' by *shifting* them toward DIY science-in-action, where these offer aesthetic, artistic and media engagements. The result is 'unmonumentalised' AMs: Smithsonian non-sites of Anthropocenic production. Artistic-research is methodologically inspired by STS, History of Science, Ethnography and Anthropology, and traditions of Land Art. 'Shift Register' channels geoscience field and laboratory methods towards contemporary artistic procedural and media forms, while extending links between 'art and technology' and DIY and citizen science. These orientations elicit a three-stream project (see Figure 1):

- *Research Stream 1—Anthropocene (Re)Production (M1-M12)*: Mapping of media-discursive foundations of the Anthropocene and its markers.[98] Contextualisation via histories,[99] literature[100], media-technical tools (eg.: sensor networks and satellite imaging),[101] art works and exhibition.[102] Also, the development of hands-on, DIY 'versions' of geoscience that determine AM markers, as scientific material/media analytic.
- *Research Stream 2—Anthropocenic Fieldwork (M13-30):* Fieldwork at relevant AM marker sites for media and material sampling and testing, and sensory-ethnography[103] oriented interventions, selecting artefacts (media and material) and observations for abilities to 'sensitise' AMs, and workshops with diverse publics at the Earth Lab (see below).
- *Research Stream 3—Focus: Earth Lab (M30-36)*: Evaluation, elaboration, synthesis and presentation of project research at the Earth Lab (Basel). A key geological artistic-research innovation, the Earth Lab is a longitudinal site for geological-media experiments, documentation, and forms a backdrop for research visits and public project output presentations in an aptly in-the-wild and earth-bound environment.

An invitational public workshop takes place at the project mid-point (with invited specialists and open call for other contributions), and a final exhibition with invited critical artistic-responses at its end. The project will generate two

[97] Bonneuil, C. (2016). Shock of the Anthropocene: The Earth, History and Us. Verso. p. 67.
[98] Autin, W. & Holbrook, J. (2012). Is the Anthropocene an issue of stratigraphy or pop culture. GSA Today, 22(7), 60-61.
[99] Eg.: Chamberlin T. C. (1897) A group of hypotheses bearing on climatic changes J. Geol. 5 65.
[100] Frisch, M. (1994). Man in the Holocene. Harcourt; Williams, R. (2013). The Triumph of Human Empire. U of Chicago.
[101] Haff, P. (2014). Humans and technology in the Anthropocene: Six rules. The Anthropocene Review, 1(2), 126-136.
[102] O'Connor, R. (2008). The Earth on Show: Fossils & the Poetics of Popular Science. University of Chicago Press.
[103] Pavsek, C. (2015). Leviathan and the Experience of Sensory Ethnography. Visual Anthropology Review, 31(1), 4-11.

(2) high-quality published journal outputs during the last two years: artistic project publishing (U.S.-based Art Papers) and a digital Final Project Book publication (K-Verlag and Urbanomic publishers, letters of support attached). The Earth Lab (EL) serves as an in-progress and final site for a public exhibition event as the project culminates, as open-lab process-exhibition, lasting two weeks. Although not a condition for overall success, along with exhibition partners (letters of support attached), we intend to multiply the project's impact via cultural funding bids to support further exhibitions of project results, using research publications as exhibition prospectuses (Pro Helvetia, Migros Foundation, Arts Council England, Arts Council of Canada, are prospective partners in this).

Over the course of the project which encompasses 36 months, monthly full-membership Project Management (PM) are held, with minuting and actions, mandatory for project researchers. Figure 2 gives an overview of research activities and outputs.

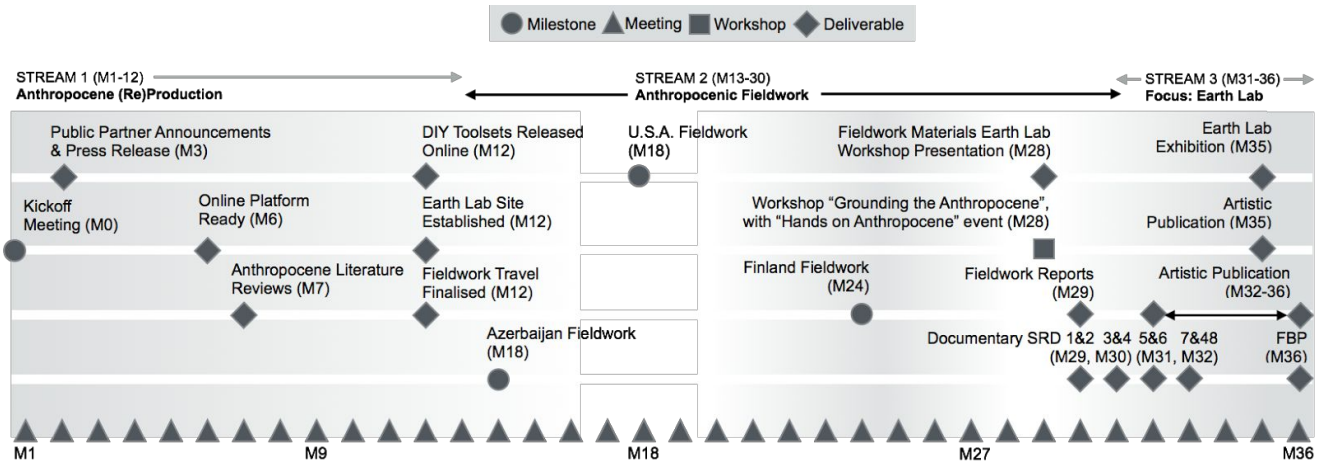

Fig. 2 — Summary of project streams in diagrammatic form showing deliverables and select milestones.

2.3.1. Research Stream 1 — Anthropocene (Re)Production — (M1-12)

Along with project start up tasks, this first research phase undertakes media- and literature-research (M0-M6), developing the cross- and extra-disciplinary conceptual resources that allow and have allowed anthropocenic marking to occur. Often presented as a recent 'awakening', humans have historicised ecological impacts regularly through descriptive criticism and aesthetic challenges. A collection and selection of excerpts, quotes and references to anthropocenic themes in geoscience, history,[104] geography,[105] socio-anthropology,[106] politics[107], art[108], media[109] and land art[110] media will provide consultation basis for their imaginings and forms[111] (M1-6).

Centrally, *Research Stream 1* involves intense collaboration between artistic researchers and Environmental Humanities researchers (collab. Kueffer). Specific geoscience and geochronologies that underlie AM determinations[112] are translated toward DIY and citizen-oriented art-research techniques that can be detailed and documented. Such to-be-translated geoscience methods, relevant to the kinds of AM markers and fieldsites chosen include:

[104]Robin, L., & Steffen, W. (2007). History for the Anthropocene. History Compass, 5(5), 1694-1719.
[105]Lorimer, J. (2012). Multinatural geographies for the Anthropocene. Progress in Human Geography, 36(5), 593-612.
[106]Hamilton, C., et. al (Eds.). (2015). Anthropocene & the Global Environmental Crisis: Rethinking modernity. Routledge.
[107]Purdy, J. (2015). After Nature: A Politics for the Anthropocene. Harvard.
[108]Braddock, A. C., & Ater, R. (2014). Art in the Anthropocene. American Art, 28(3), 2-8.
[109]Wark, M. (2015). Molecular Red: Theory for the Anthropocene. Verso Books.
[110]Lippard, L. (2014). Undermining: Words and Images through Land Use Politics in the Changing West. New Press.
[111]Heller, C., & Pezzani, L. (2014). Forensis: The Architecture of Public Truth.
[112]For example, Raju, R. D. (2009). Handbook of Geochemistry: Techniques & Applications. GSI Publications, 3(1).

- Dendrochronology (tree ring characterisation) and phenology (seasonal change observation) via spectroscopic and colorimetric techniques, growth measurements, optical-media and software analyses;
- 'Smear slide' preparation where visual slides of materials are prepared with transparent plates in solution.
- 'Peels and stacks' documenting layers in soil. 'Peels' involve exposing the face of a soil and then applying latex fixatant to it, and then 'peeling' off a record of soil layers. 'Stacks' are similarly fixated 'tubes' of soil.
- Analysis of artificial radionuclides in plant and soil samples using scintillation probes.
- Sunlight/ozone analyses including ozone spectrometry and pyranometry (solar radiation).

The second half of *Stream 1* elaborates specific, conjoined DIY, citizen and artistic methods for the shifting of these scientific techniques towards grounded, performative and embodied aesthetics (M6-M12). These are documented, exposed and later employed in fieldwork and laboratory work. Public and citizen-oriented projects like the DIY pyranometer,[113] Open Source toolsets SpectralWorkbench[114] (spectroscopy) and Theremino[115] (radionuclides quantification) are integrated into laboratory and field 'kits' for collection, analysis and evaluation. *Register shifting* methods are:

- A primary strategy of the project shifts from industrial and 'closed-door' laboratory and field science towards more performative, open and embodied aesthetics of DIY and citizen science (resp. All);
- Shifting of site, toward new contexts and/or the EL (eg.: Smithson's non-site) through media and material transfer: eg. oil sample collections re-construed in new contexts (field→lab→DIY→exhibition) (resp. All);
- Time-space scalar shifts (after Kahn, Kittler), allow shifting of geological histories as 'speeding up' or 'slowing down' (temporal remapping) as, for example, media-technical sonification and visualisation. Fast and slow geochemical reactivities and metamorphoses are slowed or sped to 'human' rates (resp. Howse, Kemp);
- Shifts allowing for the introduction of 'inadmissible' methods, tools and hardware. Meyer-Brandis "Teacup Tools" project serves as a relevant example of this strategy, as the introduction of domestic hardware and materials into the highly specific material culture of lab and field science (resp. Howse, Kemp);
- Shifting between individual and collective registers, using participatory artistic techniques (canvassing via online project platforms) such as relational aesthetics.[116] Eg. people digging out soil profiles where they live and 'reading' the 'story' of these soils. Pragmatic motivations to collect large data sets from diverse and remote locales are here serviced, constituting hybrid artistic, digital-ethnographic, participatory ecology methods.[117]
- Epistemic-community register shifting, through practice-orientated artist-lead workshops with non-scientific publics. Art students perform DIY spectrometry, helping research to elaborate relational aesthetic strategies.

The collection of literature and media is nominally divided into areas of emphasis: Allen looking at image based and digital representation,[118] Mareis at earth-representational design histories, Howse at the early history of AM science and 20th Century science-fictional accounts, and Kemp delving into concurrent scientific publishing and popular scientific reporting. What results is a media-literary pinboard (tumblr.com, M7) to be shared between researchers, as

[113] Martínez, M. A., Andújar, J. M., & Enrique, J. M. (2009). A new and inexpensive pyranometer for the visible spectral range. Sensors, 9(6), 4615-4634. (instesre.org/construction/pyranometer)
[114] Scheeline, A. (2015). Spectrometry with Consumer-Quality CMOS Cameras. Mobile Health Technologies: Methods and Protocols, 259-275. (spectralworkbench.org)
[115] Theremino is a citizen science software developed for gamma spectroscopy analysis. (theremino.com)
[116] Bourriaud, N., et. al (2005). Postproduction: Culture as Screenplay: How art reprograms the world. Lukas & Sternberg.
[117] Wylie, S., & Albright, L. (2014). WellWatch: reflections on designing digital media for multi-sited para-ethnography. Journal of Political Ecology, 21(1).
[118] The Internet Archive, Internet Archive Book Images (flickr.com/people/internetarchivebookimages); Yang, A. Archives of the Anthropocene at the Max Planck Institute for the History of Science (mpiwg-berlin.mpg.de); Neyrat, Frédéric. "Critique du géo-constructivisme." Multitudes 56.1 (2014): 37-47

well as with project stakeholders and partners linked to the **Online Platform** (M6). The **Earth Lab (EL)** will be initially prepared in this stream (resp. Allen & Mareis, M12). In parallel, artist researchers will develop one of three DIY laboratory-technical toolchains at the **EL** (M6): Howse for atmospheric and radionuclide techniques; Kemp for rock and soil composition; Allen for spectrometric, image-based and digital analytics. These toolchains will practically employ geoscientific techniques, 'rendered DIY' (M6-12) in such a way that they can also be transferred to fieldwork in *Research Stream 2*. These 'shiftings' will involve particular interaction with Kueffer output as research posts on the **Online Platform**. Fieldwork is arranged in *Stream 1* (Allen/Azerbaijan, Howse/Finland, Kemp/USA).

2.3.2. Research Stream 2 — Anthropocenic Fieldwork — (M13-30)

Research Stream 2 applies thinking and techniques prepared through *Research Stream 1* at field sites of anthropocenic onset. Each of the three site visits has been pre-prepared via relevant contacts as future development partners, necessary to pre-excursion preparations. Fieldwork trips constitute 14-day engagements, and involve three project researchers (Allen, Howse, Kemp) cycling organisational, documentation and experimentation tasks (1 field-expert/coordinator, 1 field researcher, 1 fieldwork documenter). The fieldwork sites, with their interest to the project, contact liaisons and project timings, are:

- Neft Daşları, a former monogorod (Russian manufacturing city), built at the start of the Great Acceleration, and the world's first offshore drilling platform, was in 2011 the subject of a filmic documentary project by Swiss director Marc Wolfensberger of Thin Line Productions (Sàrl/Ltd).[119] Relationships have been secured with Bacu State University Department of Department of Palaeontology and Historical Geology in Azerbaijan (support letters attached). (M14)
- Trinity nuclear testing facility at White Sands Missile Range in New Mexico is available to the project through contact at the U.S. artistic-research organisation The Center for Land Use Interpretation (CLUI). CLUI, founded in 1994, is a globally renowned centre for geographically- and geologically-minded artistic research and intervention, and has mapped and studied the nuclear testing history of America's Southwest. Matt Coolidge, CLUI's director, is a former collaborator of researchers Howse and Kemp (letters of support attached). (M18).
- Researches at the SMEAR II climatological field station in Hyytiälä, Finland. This field-station is managed by the University of Helsinki and is a primary centre for climatological and geological fieldwork with a history of art-science and artistic-research collaborations. Collaboration is here secured via contacts with the Finnish curatorial platform Capsula, and the Finnish Bioart Society, both with active, ongoing projects at the SMEAR II research outpost (letters of support attached). (M24)

Fieldwork registers the experience of global sites where AMs can be envisioned, captured, media-translated and directly 'touched.' Fieldwork is achieved in relatively quick succession (M14, 18, 24) in order to take advantage of qualitative, quantitative, material and media data contrasts, as well as to leverage methodological correspondences between sites. The small field team (3 researchers) is both an effective and efficient resource use for the planning, documenting, and performing of field research at these sites. Onsite, the application of conjoined DIY scientific and artistic methods proposed in Section 2.3.1 gives rise to methods applied *in situ* to materially sample and map sites' relations to AMs. Encounters with local communities, scientists, and infrastructures/engineering personnel are documented using sensory anthropological[120] and artistic-ethnographic[121] approaches (video, audio recordings,

[119]Original Title: La Cite Du Petrole (2009); English Title: Oil Rocks - City Above The Sea; German Title: Stalins Gigantomanie: Die Bohrinsel Von Aserbaidschan ("Stalin's Megalomania: The Rig at Azerbaijan").
[120]Pink, S. (2009). Doing sensory ethnography. Sage Publications.
[121]Foster, H. (1995). The artist as ethnographer?. The traffic in culture: refiguring art and anthropology, 203-309.

synchronised to ecologic and sensory signals). Materials, samples, and media are chosen based on their sensible efficacy, how they might provoke, assist and example chronoscientific dating techniques, and how amenable they are to further reworking and representation at the Earth Lab.

Field investigations, including media and sensor documentation and air, water, rock, soil and sunlight profiling, record and register field-local AM stimuli using DIY media-technical instrumentation developed at the EL. Sample sets and data at each site include: dendrochronology and phenology samples (tree/biomass section), 'smear slide' mapping of AM marker locales, 'peel and stack' soil layers, rock and plant samples for radionuclide testing, pyrometric (sunlight) profiles, audio and video of site and sample collection and interactions with local field scientist and site personnel. These are returned from each site to the EL for inspection, consolidation and preparation of field findings (M14-24), and for presentation at the **Workshop "Grounding the Anthropocene"** (M28, invitees: Ryan Jordan, Bernard Geoghegan, Bruno Latour), a public event convened to gather public scrutiny and interest. The first day of this two day, second project workshop will orientate the research for *Research Stream 3,* which more directly develops presentation, media and object-based 'unmonuments' for AMs and the Anthropocene (M28-M34). Held with the House of Electronic Arts Basel (letter of support attached), the workshop will feature a second day targeting cross-disciplinary researchers, art students, young people and the general public. The second day of this workshop, **"Hands on Anthropocene"** (M28) will feature activities that allow the uninitiated to obtain a physically intuitive relation to AMs via geoscientific methods and materials. Twenty participants (art students) over a day long event will be exposed to geoscientific field and lab methods—intended to engage publics that readily derive 'sensibilisation' strategies in the making of these kinds of measurements. Observation and documentation of these events hopes to capture the non-scientist participant's observations, insights and conclusions from these investigations. The **"Hands on Anthropocene"** event promotes an understanding while providing perspectival input to the Shift Register project towards unmonumentalisation strategies, i.e.: linking direct experience with Earth-magnitude phenomena.

Stream 2 includes processing, evaluating, archiving, and editing fieldwork materials at the EL toward written reflection, online presentation, and exhibition (M28, resp. Kemp). **Fieldwork Reports** (3 PDFs) featuring fieldwork visual materials, workshop-derived writings, and reflections by field researchers, will be released via the project's **Online Platform**, and disseminated widely online via project stakeholder networks (M29), with illustrations and photos. Other fieldwork media will be prepared as **Shift Register Dispatches (SRD)**—a series of 8 edited, documentary web video 'reports from the Anthropocene' derived from field site work and workshop work at the Earth Lab (2 released in each M29, 30, 32, 34). Two (2) collaboratively authored journal articles are to be drafted for submission to The Anthropocene Review, Leonardo, and Media Culture and Society peer-reviewed journals, recounting project themes, fieldwork results and reflections, as well as speculation on project outcomes (drafts for M30). Planning of the digital **Final Project Book (FPB)** begins nearing the end of *Research Stream 2* (M29).

2.3.3. Research Stream 3 — Focus: Earth Lab — (M31-36)

Research Stream 3 distills results from media-literature and fieldwork activities, towards the development of 'unmonumentalising' artistic approaches, processes, media, technologies and artefacts at the EL—as a mode of artistic critique opposing the vast tradition of exaltation, awe-inspiration and unquestioning affirmation of technoscience achieved by both modernism, and modern art. Permanent epoch-marking inscriptions of fact, datum, and reference are to be supplanted and described more fully as conditional, uncertain and reasonably unaccountable. Grounding the remote locales of fieldwork towards the central local of the **EL** allows for a triangulated comparison and contrasting of

field conditions and perspectives—as there is no 'global' view of the Anthropocene, but only such partial constitutive glances. At the **EL**, the following will take place:

- Simulation of industrial AM-driving processes. For example, within many metal/earth extraction processes an outflow of acidic water is provoked by the weathering of now-exposed rocks. Such geologic extraction and other such processes effecting AM markers can be simulated, at laboratory scale (resp. Howse);
- Follow-up fieldwork methods 'deconstruction' and description, around specific AM dating techniques: petrochemical analysis, dendochronology (tree ring), radionucleotide testing. Examination of how these methods function at the Earth Lab provide results for lab/field comparative analysis (resp. Howse);
- A concentration on material-aesthetic relations between materials from fieldwork sampling and local lab activities constitute an insertion into the local geo-ecology of the **EL** site (M24-36). Studio-experimentation in mark-making, language, performance, sculptural, object and media form artistic-analysis of fieldwork and laboratory materials, formulated as DIY science (resp. Kemp);
- Public invitation for stakeholders to view and participate in AM unmonumentalisations forms part of methodological activities at the **EL** through workshops and **Earth Lab Exhibition** (M35-36) (resp. Allen);

Research Stream 3 comprises mostly **EL**-bound activities, itself a novel longitudinal artistic-research infrastructure, comprising workspace, discourse staging and exhibition/documentation environment. It is a bare-earth (unfloored) tented site secured at Dreispitz campus, adjacent to IXMD's **Critical Media Lab** (ixdm.ch) and the **HeK** (Haus der elektronischen Künste, hek.ch). Set up during *Research Stream 1*, and built up as 'artistic research fieldstation' over the entire course of research. *Research Stream 3* concentrates on unmonumentalising prior uncovered concepts, methods and findings via aesthetic actions (media, material, electronic, performative 'responses'). Artistic-research writings towards finalising 2 reflexive articles and the digital **FPB** are a focus of *Stream 3.* The **Earth Lab Exhibition (ELE)** is developed (M35), held at the Critical Media Lab Basel, HEK and the **EL**, as public invitation to academic-artistic communities concerned with Anthropocene topics. The **ELE** will include enactment and invited critical responses from relevant artist-researchers, again at the **EL** facility (invitees Charles Stankievech, Rosemary Lee, Ursula Biemann). Collaborative finalisation of **2 journal articles** will summarise project findings, document aesthetic responses, and evaluate the critique of artistic incursions into AM discussions (M32). The digital **FPB**, issued in collaboration with publication partners (M36, K-Verlag, Punctum books) and an **Artistic Publication (AP)** feature (graphic and text 'spread') in the internationally distributed arts-research focused magazine Art Papers will be published (M36, support letters attached). *Research Stream 3* includes **FPB** design-development (M28), and online releases of visual and audio multimedia **SRD** (M32, 34) leading up to, and soliciting interest in, the **ELE** and **ELS** at the **EL** (M35-36).

2.4. Schedule and Milestones

Three research streams are here planned and scheduled as months (MX), deliverables (DX), milestones (SX). The below is colour coded according to areas of responsibility: Allen, Mareis, Howse, Kemp, Kueffer.

2.4.1. Research Stream 1 — Anthropocene (Re)Production — M1-12

MILESTONES: S1.1-Kickoff Meeting (M1); S1.2-Announcement/Press Release communiqués prepared (M2); S1.3-Online Platform designed (M3); S1.4-Literature Reviews and Multimedia Collections (M6); S1.5-DIY toolset feasibilities and budgets (M7); S1.6-DIY toolset proofs of concept (M8); S1.7-DIY toolset sourcing (M9); S1.8-DIY toolset prototype (M10); S1.9-DIY tool fieldtests (M11); S1.10-DIY toolset data evaluation (M12); S1.11-Fieldwork detailing and site confirmations (M12). **DELIVERABLES**:

- D1.1 — Public and partner announcements & Press Release (M3) / resp. Allen & Mareis
- D1.2 — Online Platform ready (M6) / resp. Kemp
- D1.3 — Anthropocene Literature Reviews released via Online Platform (M7) / resp. Howse
- D1.4 — DIY toolsets released online (M12) / resp. Kemp & Kueffer
- D1.5 — Earth Lab site established, secured and ready (M12) / resp. Allen & Mareis
- D1.6 — Fieldwork finalised and travel arranged (M12) / resp. Allen, Howse, Kemp

2.4.2. Research Stream 2 — Anthropocenic Fieldwork — M13-30

MILESTONES: S2.1-Azerbaijan Fieldwork pre-preparation and plan finalisation (M13); S2.2-Azerbaijan Fieldwork in Neft Daşları, Baku (M14); S2.3-Azerbaijan Fieldwork data consolidation and initial thematic analysis (M15); S2.3-U.S.A. Fieldwork pre-preparation and plan finalisation (M17); S2.4-U.S.A. Fieldwork at White Sands Missile Range (M18); S2.5-U.S.A Fieldwork data consolidation and initial thematic analysis (M19); S2.6-Finland Fieldwork pre-preparation and plan finalisation (M23); S2.7-Finland Fieldwork at SMEAR II climatological fieldstation (M24); S2.8-Finland Fieldwork data consolidation and initial thematic analysis (M25); S2.9-Media Document and sample complement consolidation at the Earth Lab (M24); S2.10-Consolidation of fieldwork materials (M24); S2.11-Workshop "Grounding the Anthropocene" with "Hands on Anthropocene" event finalised and announced (M24); S2.12-Earth Lab Preparation for workshops and fieldwork integration (M27); S2.13-FPB Digital publication planning (M29); S2.14-Journal paper 1st draft preparation (M30). **DELIVERABLES**:

- D2.1 — Fieldwork materials Earth Lab workshop presentation (M28) / resp. Kemp
- D2.2 — Workshop "Grounding the Anthropocene", "Hands on Anthropocene" (M28) / resp. Howse
- D2.3 — Fieldwork Report released via Online Platform (M29) / resp. Allen & Mareis
- D2.4 — Documentary web-video SRD 1&2, 3&4 (M29, 30) / resp. Howse & Kemp

2.4.3. Research Stream 3 — Focus: Earth Lab — M31-36

MILESTONES: S3.1-Journal paper 2nd draft (M32); S3.2-FPB design ready with draft content of (M28, M34); S3.2-AP design (M35); S3.3-EL Exhibition event finalised and announced (M30); S3.4-EL exhibition documentation (M36); S3.5-Subsequent/touring exhibition feasibility evaluation (M36). **DELIVERABLES**:

- D3.1 — Documentary web-video SRD 5&6, 7&8 (M32, 34) / resp. Howse & Kemp
- D3.2 — Submission of 2 articles for peer-review (M32-36, according to deadlines) / resp. All
- D3.3 — Artistic Publication with Art Papers magazine (M35) / resp. Allen
- D3.4 — FPB out via Online Platform and partners (M35-36) / resp. Howse & Kemp
- D3.5 — Earth Lab Exhibition event (M35-36) / resp. Allen & Mareis

2.5. Relevance and Impact

AMs provide a sublimated object that registers across the social, political, biological and geological domains into which humans are increasingly enfolded. By examining the described topics, 'Shift Register' examples a highly innovative, novel and cross-cutting artistic research that is interested in scientific and artistic practices, but oriented towards impacting broader, non-scientific and non-fine-art communities. 'Shift Register' researchers have proven records in communicating experimental artistic research, through publication and exhibition internationally. It is a unique opportunity for the research team to catalyze and synthesize innovative approaches and outlooks across and outside of disciplinarian framings. The project will contribute powerful research models and new artistic-research methodologies. The final Earth Lab exhibition creates impactful public engagement with geological and artistic material realities for diverse publics, while challenging typical art-science collaboration dynamics. Engaging DIY media-technologies and citizen science vanguards, 'Shift Register' presents a timely interventionist research into the Anthropocene—a topic that will continue to dominate cultural discourse for many years to come. Media-philosophical issues addressed, regarding human-technicity, anthropocenic ambivalence, and the aesthetics of science (as 'productive STS in action'), ensure widespread import and impact within international, peer-scrutinised outputs including online network dissemination, publication, and exhibition. Project impacts are to be evaluated in terms of peer-generated critical response, researcher-authored publication in named venues, audience development (online and offline), and public dissemination towards future showcases of the project across artistic-research networks and venues.[122]

[122]Network links include Transmediale, Berlin (transmediale.de); Corner College, Zurich (www.corner-college.com); ISEA (isea-web.org); Liquid Architecture, Melbourne (liquidarchitecture.org.au); Furtherfield, London (furtherfield.co.uk); RIXC, Riga (rixc.lv); FoAM, Brussels (fo.am); National Institute for Experimental Arts, Australia (niea.unsw.edu.au); Piet Zwart Institute, Rotterdam (pzwart.nl).