Ca' Foscari University of Venice

PROJECT ACRONYM AND TITLE: **AiCE: Deep ice - Deep learning. Artificial intelligence revealing the oldest ice climate signals**

FUNDING PROGRAMME: **Horizon Europe**

CALL: **ERC-2022-COG**

DESCRIPTORS: ***polar ice cores, ice core impurities, ice core record preservation, laser ablation, computer vision, Beyond EPICA***

HOST DEPARTMENT: **Department of Environmental Sciences, Informatics and Statistics**

SCIENTIFIC RESPONSIBLE: **Pascal Bohleber**

FINANCIAL DATA:

Project total costs	Overall funding assigned to UNIVE
€1.937.308,00	**€1.937.308,00**

ABSTRACT:

We are missing a central piece in the puzzle to understanding our Earth's climate: Its dynamics fundamentally changed during the "Mid-Pleistocene Transition", when some 1.2 million years ago the oscillation between warm periods and ice ages shifted its periodicity from 41 to 100 ka. A key set of information about this change was archived in the snow that fell at that time in Antarctica. At unique locations, that snow is still preserved today in the deepest ice layers– but does it still contain its original message? AiCE will answer this key question specifically using chemical impurity signals which make up a large part of the ice core record about past atmospheric conditions. For this purpose, we take a new approach to study the oldest and highly thinned layers at unprecedented detail. While conventional meltwater analysis delivers 1D cm-resolution signals, we go into 2D by imaging the chemical impurity distribution at micro-metric scale in the solid ice core. This way, we can retrieve crucial information that is inevitably lost by melting: The same ice matrix preserving the climatic record can act on it and ultimately destroy it through various processes, causing impurities to relocate away from their original layer. Hence, the goal is to identify the original layering, by detecting post-depositional change through analyzing highly-dimensional chemical images. However, human observers have clear limitations in detecting all the important details in such complex visual datasets. This is why AiCE will add deep learning to deep ice: Artificial intelligence (Ai) image analysis will be established through a comprehensive understanding of the chemical image features and their connection to post-depositional processes. With this, we can address the fundamental climate questions through deciphering deep ice – in Antarctica and elsewhere. Ultimately, AiCE could revolutionize how we interpret the oldest paleoclimate signals in ice cores and other archives.

Planned Start date	Planned End date
01/01/2024	31/12/2028

PARTNERSHIP:

1.	**Ca' Foscari University of Venice**	Italy	Beneficiary