This special issue comprises a series of papers written by former PhD students, as well as friends and colleagues, to celebrate the career of Alayne Street-Perrott, who is currently Professor of Physical Geography at Swansea University. Alayne's research career has been exceptional, marked by novel, cutting-edge research of the very highest quality in several disciplines, which addresses ‘big’ questions in Quaternary Science. She has promoted the importance of tropical environments through international cooperation and leadership, and developed fundamental concepts. She has made an immense contribution to our understanding of global change in the Quaternary, raising the discipline to new levels of scientific rigour.

Figure 1.

Alayne Street-Perrott, standing in Lake Cuitzeo, Central Mexico, April 1981 (photo credit: Sarah Metcalfe, University of Nottingham).

Alayne started her academic career with a degree in Geography from the University of Cambridge, followed by an MA in Geography & Geology from the University of Colorado. Her long interest in lakes and palaeoclimate began when she returned to Cambridge to undertake a PhD on the Late Quaternary palaeohydrology of East Africa based on lake-level change in the Ziway-Shala Basin, Ethiopia, under the supervision of Dick Grove. During her time at Cambridge, Alayne was also a visiting scholar at Addis Ababa University, Ethiopia, holder of a Royal Society Leverhulme Studentship and Attachée de Recherche, Laboratoire de Géologie du Quaternaire, CNRS, France. After her PhD, Alayne moved to the University of Oxford's School of Geography, eventually becoming Programme Leader in Palaeoclimatology at the Environmental Change Unit. She took up her current post of Research Professor (Physical Geography) in Swansea in 1995.

Alayne's work is focused on palaeoclimatology and biogeochemical cycling, mainly in low-latitude regions and with particular emphasis on lake-sediment and peat records, but also involving comparisons of palaeoclimate data with modelling experiments. Her ground-breaking research has employed, and indeed developed, a wide variety of sedimentological, geochemical, isotopic and palaeoecological indicators for a diverse array of problems. Her early work on tropical lake-level variations (e.g. Grove *et al*., 1975; Street and Grove, 1976, 1979) inspired new directions in the use of databases in Quaternary science (Street-Perrott and Roberts, 1983; Street-Perrott and Harrison, 1984, 1985; Street-Perrott *et al*., 1989a) and as well as moving forward our understanding of the Quaternary in the tropics, which had hitherto been largely overlooked (Street, 1981). Her work on Milankovitch forcing of tropical monsoons undoubtedly paved the way for our understanding of long-term cycles of effective moisture in low-latitude regions, and involved broad international cooperation (e.g. within the Cooperative Holocene Mapping Project, COHMAP) with other palaeoclimatologists and with climate modellers (Kutzbach and Street-Perrott, 1985; COHMAP Members, 1988). Kutzbach and Street-Perrott (1985) is especially noteworthy as being very highly cited, with more than 600 citations at the time of writing.

During the late 1980s and early 1990s, Alayne began to turn her attention to abrupt climate change. She was among the first scientists to identify the existence and significance of sub-Milankovitch-scale climate changes in low-latitude regions and the role of North Atlantic circulation in their forcing (Street-Perrott and Perrott, 1990; Street-Perrott, 1991). Subsequently, Alayne was a co-investigator in the NERC-Funded RAPID project on isotopes in precipitation as tracers for abrupt Holocene climate change events in the circum-North Atlantic region (Daley *et al*., 2011), playing a key role in the development of studies of oxygen isotopes in peat cellulose (e.g. Daley *et al*., 2010, 2009; Loader *et al*., 2015), a methodology that has since been applied in South America (Daley *et al*., 2013). She has also long had interests in the role of humans and natural environmental processes in environmental change. The work of Alayne and her students in Mexico has helped to identify the complex interplay between climate change and human activity in driving landscape change during the Holocene (O'Hara *et al*., 1993). More recently, Alayne has turned her attention to palaeoenvironmental records of elemental cycling, using novel molecular isotopic indicators. In the high-altitudes of East Africa, Alayne revealed important findings about carbon cycling, and the role of pCO_2 as a driver of vegetation change on glacial–interglacial cycles from her lake studies (Street-Perrott *et al*., 1997, 1998, 2004, 2007; Ficken *et al*., 1998; Barker *et al*., 2001; Huang *et al*., 2001). Her work on the silicon cycle (Street-Perrott and Barker, 2008; Street-Perrott *et al*., 2008) in lacustrine environments is at the cutting edge. After her 2014 EGU presentation, she was invited to review orbital forcing on the silicon cycle that she discovered in East African lakes, for *Quaternary Science Reviews*. The resulting paper (Cockerton *et al*., 2015) is an internationally significant contribution to this emerging science area. Alayne's regional specialisms have been in challenging parts of the world including East, West and North Africa (Street and Grove, 1976; Olago *et al*., 2000, 1999; Street-Perrott *et al*., 2000; Wooller *et al*., 2000; Cockerton *et al*., 2013), Mexico (Street-Perrott *et al*., 1989b; Metcalfe *et al*., 1989; O'Hara *et al*., 1994) the Himalayas (Derbyshire *et al*., 1984; Goudie *et al*., 1984; Street-Perrott and Goudie, 1984; Holmes *et al*., 1992; Holmes and Street-Perrott, 1989) and Jamaica (Street-Perrott *et al*., 1993; Holmes *et al*., 1995a,b). Until very recently, she has accompanied students in the field in these difficult regions, a testament to her career-long dedication to the advancement of her science. She has also been involved in the scientific supervision of students working in New Zealand (Stephens *et al*., 2012a,b).

Alayne has made countless contributions to the national and international research community throughout her career including NERC, the Royal Society, the QRA and RGS/IBG within the UK, and has represented UK global change science within COHMAP, PMIP, IPCC, IAMAP, IDEAL and INQUA. She has attracted prestigious amounts of funding from RCUK and other sources. She has recently been the recipient of a Lifetime Achievement Award from the International Paleolimnology Association (IPA) and was the 2015 winner of the Croll Medal of the UK Quaternary Research Association (QRA).

The papers in this volume reflect the breadth of Alayne's interests. Parker *et al*. (2016) examine sediment fluxes in early to mid-Holocene palaeo-lake deposits from the Arabian Peninsula and assess their palaeohydrological significance. Although Alayne has not worked in this part of the world, the study parallels the work that she led in the mid-1990s on Holocene interdunal lake sediments in West Africa, which formed a major part of the NERC-funded SAHEL (Subsaharan Africa; Hydrogeology, Environment, Limnology) project (Holmes *et al*., 1999a, 1998, 1997,b; Street-Perrott *et al*., 2000; Cockerton *et al*., 2014). It also makes a contribution to our understanding of the Holocene evolution of the African–Arabian monsoon system, which has formed a major part of Alayne's interests.

Webb *et al*. (2016) undertake a systematic assessment of the fractionation of carbon isotopes into diatom frustules and the extent to which diatoms can provide natural archives of information about carbon cycling in lakes. This work echoes Alayne's interests in lacustrine archives of carbon cycling (e.g. Street-Perrott *et al*., 1997) and her pivotal role in the use of isotope tracers in biogenic silica to understand nutrient cycles and continental weathering (e.g. Leng *et al*., 2008). Alayne was the spearhead of the now well-established Isotopes in Biogenic Silica (IBiS) working group, who have met regularly over the last decade to discuss advances in biogenic silica research (e.g. Leng *et al*., 2008).

Alayne has long had research interest in Central Mexican climate and environment, first undertaking fieldwork there more than 30 years ago. The papers by Holmes *et al*. (2016) and Metcalfe *et al*. (2016) both relate to sites in Mexico. The former paper is based on a late Pleistocene palaeolimnological record from La Piscina de Yuriria, a crater lake from the Trans-Mexican Volcanic Belt. It uses a multiple-indicator approach to reconstructing climate and catchment history during the late Pleistocene. Results show that whereas earlier phases of catchment disturbance were probably climatic in origin, increased catchment erosion during the Holocene was increasingly mediated by human activity. Alayne herself was involved in the coring of La Piscina de Yuriria and led the initial work at that site (as well as many others in Central Mexico), supervising or co-supervising three PhD students who worked there in the 1980 and 1990s. The paper by Metcalfe *et al*. (2016) presents an early to mid-Pleistocene palaeolimnological record from Valsequillo Basin, also in Central Mexico. The authors present multiple lines of evidence to characterize the past lacustrine system at this important megafaunal and palaeoanthropological site. The paper by Carson *et al*. (2016), which is focused on the Bolivian Amazon, uses a mid- to late Holocene lake-sediment record to investigate pre-Columbian impacts on the environment using palaeoecological evidence. The study has strong parallels with work done by Alayne and her former students on anthropogenic modifications of the Central Mexican landscape (e.g. Metcalfe *et al*., 1989, 1994; O'Hara *et al*., 1993).

Roberts *et al*. (2016) present multiple-indicator records from two lake-sediment sequences in Cappadocia, Turkey. By comparing multiple climatic and environmental proxies from two lake sequences they are able to disentangle regional climate signals from those related to

basin-specific processes, thus demonstrating the importance of careful site-specific evaluation of individual palaeolimnological records and the potential value of multiple-site approaches in palaeolimnology. This work echoes Alayne's characteristic approach of investigating each site in painstaking detail, while striving to identify regional patterns of change in the wider climate and environment from the site-specific records.

Alayne has long held interests in comparisons between climate modelling experiments and palaeoclimate data (Street-Perrott, 1991) arising initially from her work with the Oxford lake-level databank (e.g. Street-Perrott and Harrison, 1985), which was applied to understanding orbital forcing of monsoons (e.g. Kutzbach and Street-Perrott, 1985; Street-Perrott *et al*., 1990; Street-Perrott, 1991) and made an important contribution to the COHMAP project (COHMAP Members, 1988). Harrison *et al*. (2016) provide a comprehensive overview of the contributions that palaeoclimate data have made to climate modelling experiments.

Wils *et al*. (2016) present an analysis of adaptation of African trees to increasing CO_2 levels over the recent past and into the future. Although Alayne's work has not directly focused on trees, this paper complements her research in two ways. First, her work on the East African mountain lakes over the last glacial cycle has led to important discoveries about the impact of changing pCO_2 on tropical forests. Second, Wils *et al*.'s study focuses on Ethiopia, where Alayne worked for her PhD, albeit on lakes.

Stevens *et al*. (2016) present a paper that examines the chronology of loess deposits in China and the role of monsoon forcing. This paper relates to Alayne's work on monsoons and insolation forcing. Closer to home, MacLeod and Davies (2016) present a critical interpretation of tephra in Slaggan Bog, a coastal site in north-west Scotland. These authors take on a controversial topic and thorough development of the methodology. One of the characteristics of Alayne's work is to challenge orthodox interpretations and propose alternative explanations, for example in her papers on the silicon cycle.

Alayne has also been at the forefront of developments of new isotope tracers, for example in her work on *Sphagnum* cellulose from peat bogs. Two papers presented here by Daley *et al*. (2016) and Loader *et al*. (2016) are concerned with Holocene climate variability based on such records from Newfoundland and Patagonia. In the former, the authors present the first combined oxygen and hydrogen isotopic palaeoenvironmental record from *Sphagnum* cellulose from a peatland and show that the $\delta D/\delta^{18}O$ bi-plot correlates directly with existing measurements of the modern isotopic composition of precipitation from GNIP stations in Nova Scotia and Labrador, implying a close relationship between the estimated isotopic composition of source water used by the mosses and that of the source precipitation. In the latter, the authors explore the potential of a site-specific ‘space-for-time’ approach, which they applied to a hummock–hollow transect on an ombrotrophic raised bog. Results reveal a range of environmental responses and the authors thus recommend conducting site-specific characterization of plant responses before the development of peat isotope records for palaeoenvironmental research.

The papers in this volume are a reflection of an exceptionally broad and diverse scientific career. Moreover, they also reflect a clear direction of travel in the subject from a relatively descriptive science with a focus on temperate and high latitudes to a global system perspective in which tropical processes propagate broad-scale changes and biogeochemistry connects atmospheric, terrestrial and aquatic environments. Future studies by Quaternary scientists using molecular, genetic and even Big Data approaches will benefit from Alayne's

pioneering ability to harness state of the art techniques for the understanding of changes in Earth systems during the Quaternary period.

Alayne's exceptional career to date has included the authoring of more than 130 publications (see her Google Scholar listing for further information). Moreover, she has inspired and mentored a second and third generation of men and women in Quaternary science, including a good number who are now professors and scientific leaders in their own right. Alayne's research has been supported by her family. Her husband Alan Perrott's formidable logistical and field skills were the foundation of their major research projects in East and West Africa, Jamaica and Mexico. Alan very sadly died in 2002. Their daughter Marie has, over the years, been well known to the scientific community as an accompanying member on various field campaigns and conferences.