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The contribution of women to Welsh geological research and education up to 1920

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ABSTRACT

The importance of Welsh geology to the development of the science of geology and the stratigraphic column is underestimated and indeed the contribution of women to this process is largely overlooked. This paper explores the scientific contribution and the role that women played to the investigation of Welsh stratigraphy. The work of Gertrude Elles, Ethel Skeat, Ethel Wood and Margaret Crosfield, the so-called Newnham quartet of palaeontologists, and the educational contribution of Dilys Davies, the first female to study geology at Newnham College, Cambridge and of Annie Greenly to the work of her husband Edward Greenly on Anglesey is discussed. Catherine Raisin also contributed work on the metamorphic rocks of Wales and her work is examined. Without their contributions, Welsh stratigraphy would not be as advanced as it is today especially in the use of graptolite identification for correlation. However, scientific research was not the only contribution and other roles such as illustrators, proof readers, field assistants and teachers will also be examined against the background of the time. The fact that there were few higher education institutions in Wales at the time admitting women to geology is a significant factor for geological research. The contribution of female researchers to this research development is largely forgotten by both researchers, educators and the general public. This paper hopes to rectify these omissions.

1. Introduction

The main aim of this paper is to show the importance of female researchers and educators to research within a Welsh context and to raise the awareness of women's geoscientific contribution at a time when women researchers were few and far between in the UK. The research is ongoing and new discoveries of important contributions by women to this challenging and dynamic time in the Earth Sciences will continue to happen.

Within the broader context of female education the important turning points were 1870 and 1875 which firstly introduced the Elementary Education Act (1970) initiating universal public elementary education in place of private schools and secondly in 1875 the admittance of women into universities (Burek, 2009a). The first dictated the need for teachers to be trained and the second gave a mechanism for that process to happen. The Welsh context for that to happen will be covered in Section 3.

Wales and Welsh geology have played a key role in the developmental history and understanding of stratigraphy as shown by the naming of the base of the geological Phanerozoic timescale, *i.e.* Cambrian, the Roman name for Wales. This is widely recognised internationally by geologists but the general public living in Wales, let alone the rest of the UK, do not realise the importance of their country's contribution to scientific knowledge. This is coupled with a general lack of understanding of the role that women played in the development of geoscience (Burek and Higgs, 2007a; Higgs, pers. comm., 2014), whether in Wales or across the UK. This research on both raising public awareness of the Welsh contribution to geological research and the role of women in its development, was initially developed for the Welsh Assembly Government (WAG) funded Welsh Women's road show (2009–2010) and has since then been expanded. The main female drivers for this research lived outside Wales; Gertrude Elles, Ethel Skeat, Ethel Wood, Margaret Crosfield, Catherine Raisin, Annie Greenly, Dilys Davies, Mary Johnston, Helen Drew and Ida Slater but some did move into the Principality during the time period under study.

1.1. Development of Welsh stratigraphy

The importance of Welsh stratigraphy is shown by the contributions of Roderick Murchison (1792–1871) and Adam Sedgwick (1785–1873) which are legendary (Secord, 1986).

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Fig. 1. Map of Wales showing locations mentioned in text and Iron Age tribes.

However the violent disagreement between them about the Cambrian/Silurian boundary was only resolved after their deaths by Lapworth (1842–1920) with the introduction of a Mid Lower Palaeozoic Period: the Ordovician proposed by Lapworth in 1879 and accepted by the Geological Community in 1906 (see Table 1). This name comes from a Welsh Iron Age tribe (Fig. 1 and Table 1).

The role that women have played in this stratigraphic research is less well-known. Two women in particular played an important part in the stratigraphic story: Gertrude Elles (1872–1960) and Ethel Wood later Mrs. Shakespear (1871–1945). Their work is constantly referred to by researcher but many people do not know that they are female as their seminal work is always referred to by their surnames – Elles and Wood (1901–1918).

Alongside the development and naming of the stratigraphic column, North Wales and more specifically Anglesey (Fig. 1) have contributed to the understanding and occurrence of some of the oldest rocks in the UK. The associated metamorphism, especially the serpentenites, that accompanies rocks of that Precambrian age was researched by Catherine Raisin (1855–1945) with Professor Bonney (1833–1923) of University College, London (Bonney and Raisin, 1899; Burek, 2004). Raisin's work on the petrology of this group of rocks advanced the whole understanding of metamorphic fabrics and serpentenite mineralogy.

Table 1
The Lower Palaeozoic timescale.

Era	Period	Origin of name	Origin
Lower Palaeozoic	Silurian	Welsh Iron Age tribe	Sedgwick and Murchison (1835) (Global recognition 1839)
	Ordovician	Welsh Iron Age tribe	Lapworth 1879 (Global recognition 1906)
	Cambrian	Roman name for Wales	Sedgwick and Murchison (1835)

Other women have also helped forward the understanding of Welsh geology through their different roles and the contributions of Margaret Crosfield, Ethel Skeat, Annie Greenly, Dilys Davies, Helen Drew and Ida Slater and Mary Johnston will be highlighted later.

2. The wider context of women's roles within geology

The roles that women have played in the development of the history of geology has been extensive and various (Burek and Higgs, 2007a). They have acted as collectors, indexers, and educators to illustrators and researchers. Their research was rewarded by medals and financial awards by the Geological Society of London but despite these achievements, it was only after 1919 that the Geological Society finally admitted female members to read papers and collect their research awards (Burek, 2009a). Research conducted by female geologists was presented by their male colleagues (Table 2). The use of the funds to forward research when appropriate within Wales is discussed in the write up of the individual female geologist.

However their contribution has not been widely recognised by the general public, academic researchers and educators in general, (Burek and Higgs, 2007b; Creese and Creese, 1994). This low profile of geology being recognised as the fourth science is highlighted by the lack of geology in the national curriculum. Recent research presented at the Royal Society WISENet conference (May 2014) *Revealing lives: Women in science 1830–2000*, shows the lack of knowledge of female scientists across Europe (Higgs, pers. comm., 2014). The book *Bluestockings: The Remarkable Story of the First Women to Fight for an Education* by Jane Robinson (2009) does not even mention science in the index let alone geology.

The lost or forgotten women of Ireland associated with geology and museum curatorship, for example, have been described by Higgs and Wyse-Jackson (2007). The contribution of women to saurian research has been extensively studied by Turner et al. (2010). But to date no one has researched and brought together the contribution that women have made to the history, education and development of geology or wider geodiversity in Wales (Creese and Creese, 1994).

This paper seeks to address this omission, by looking at the contribution of women working on Welsh material during the latter part of the nineteenth and the early years of the twentieth century up to 1920. The paper will deal first with the roles women played in Wales before embarking on an in-depth look at some of the main female drivers. This is followed by an analysis of their contribution to the wider picture.

3. Women's roles – the Welsh context

To date, few papers have been published specifically on Welsh geology and women (Oldroyd, 1993; Williams, 2007). Those doing substantial work on Welsh stratigraphy have been Gertrude Elles (1872–1960), Margaret Crosfield (1859–1952), Mary Johnston (1875–1955), Helen Drew (1881–1927), Ethel Skeat (after 1910) Mrs. Woods (1865–1939) and Ethel Wood (after 1906) Mrs. Shakespear. For clarity as both Ethels have very similar names their maiden names will be used throughout except where quotes from others dictate otherwise. Catherine Raisin worked on Welsh petrology and serpentenites (Burek, 2004, 2007, 2009a, 2009b; Burek and Malpas, 2007). The important research of Emily Dix (1904–1972), who was born on the Gower Peninsula, South Wales, graduated with a first class Hons. geology degree from University College Swansea (1925) but who worked just outside our time period (her first paper was published in 1927), must be acknowledged for her internationally recognised contribution to coal stratigraphy (Burek, 2005; Burek and Cleal, 2005). The roles