George Henry Kinahan (1829 – 1908) and Maxwell Henry Close (1822 – 1903)

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George Henry Kinahan, born in Dublin in 1829, studied engineering in TCD and, in 1853, was employed on constructing the railway viaduct over the Boyne at Drogheda before completing his degree (Davies, 2004a). He joined the Geological Survey (Irish branch) in 1854, and progressed to the level of district surveyor in 1869, replacing Du Noyer in this position on the death of Du Noyer in early 1869.

Kinahan's cantankerous nature caused tensions between him and his superiors (and indeed other peers, including Du Noyer) within the Geological Survey. On the death of Joseph Beete Jukes (1811 – 1869), Kinahan had hoped to become the director of the Irish branch of the Geological Survey, but felt he was overlooked in favour of Edward Hull (1829–1917; Davies, 1983, p. 218-9). This perceived slight allowed the relationship between Kinahan and his superiors in both Dublin and London to deteriorate further, with Hull reporting Kinahan to the Director General of the Geological Survey in London on a number of occasions for 'insolence', something that Kinahan always denied (cf. Davies, 1983, 219-222). The relationship between Hull and Kinahan deteriorated to such an extent that it produced a war of words between the two in the correspondence pages of the Geological Magazine in 1879, when Kinahan was still working under Hull. Hull (as well as Sir Roderick Murchison (1792 – 1871) and Sir Archibald Geikie (1835 – 1924), Directors General of the Geological Survey of Great Britain and Ireland) threatened Kinahan with dismissal on a number of occasions, but this was never carried through, possibly because of the concern for Kinahan's wife and family, who would struggle financially if Kinahan were to be dismissed (Davies, 1983).

While Kinahan was a prolific writer about many aspects of Irish geology throughout the latter nineteenth century, his contribution to Irish Quaternary studies is twofold – the mapping of the Irish eskers, and offering a description and explanation of the glaciation of Connemara and other parts of the Atlantic coast of Ireland, thus furthering the paradigm of 'land ice', or a general glaciation of Ireland, in the 1870s. Kinahan was charged with mapping the geology of the parts of the midlands and west of Ireland for the Geological Survey in the 1860s. This brought him into contact with the eskers of counties Laois, Offaly and Roscommon, and, while the eskers had been previously referenced in the memoirs of the Geological Survey and in other texts, including archaeological, Kinahan was the first person to accurately record

these, including mapping their distribution on the six-inch field maps being used for the geological survey (figure 1). Fellow geologist on the Geological Survey George Victor Du Noyer was charged with sketching the eskers that Kinahan had mapped, for the illustrations in the memoirs that were published to accompany the one-inch geological sheets. Kinahan's explanation of the eskers was somewhat controversial for the time, and, like many of his opinions, he was not afraid to voice it (cf. Kinahan, 1864). This caused Jukes a considerable amount of annoyance, as officers of the Geological Survey were only allowed to publish with permission, something that Kinahan was reluctant to ask. The preparation of the memoir to accompany sheets 96, 97, 106 and 107 (the area of east county Galway and part of Roscommon) caused further tensions between Kinahan and Juke. Jukes remonstrated against Kinahan attempting a classification and analysis of the eskers, saying: 'Your description of the superficial deposits is also thrown in the shape of a treatise on a proposed classification of these deposits and your views upon 'eskers' – sundry terms being introduced which have not yet found a place in any of our publications' (Jukes to Kinahan, 1867). The first published edition of the memoir includes some of Kinahan's views, but firmly ascribes them to Kinahan rather than anonymising them within the text of the memoir. The text mentions that 'It has become, indeed, a prevalent opinion among geologists of late years that our islands were once coated by one vast ice cover, a supposition to which such facts as the following, described by Mr. Kinahan, lend support' (Jukes et al., 1867, p. 32).

This memoir goes on to describe the striated surfaces both in the quarries of Ryehill, county Galway, and on the railway cutting between Galway and Athenry. Kinahan included a table of rock outcrop, the 'state of the surface' (whether it is polished or not) and the first table of recorded striae direction within the memoirs. The striae directions indicate, according to Kinahan, that there were two directions of ice-flow in the area (p. 32). Kinahan postulated that these different ice flow events were temporal, but concluded that this may not have been the case. He also suggested that local topography may account for the differences (with ice flowing around minor obstacles) – however this would not account for the locations where two distinct ice-flow directions were found on the same outcrop. This work went on to form the backbone to Kinahan's major article on the 'glaciation of Iar-Connaught' which he published with Maxwell Close in 1874.

Maxwell Henry Close (1822 – 1903) was born in Dublin, and was educated at Trinity College Dublin before becoming a minister of the Anglican tradition in 1848. He ministered in Leicestershire until the death of his father in 1861, when he returned to Dublin (Bohan and

Lunney, 2013). Once in Dublin, he dedicated himself to the study of geology. His interest was piqued by the concept of glaciation, and in particular the idea that large ice sheets covered the land at some time in the recent geological past - a subject that was gaining traction in Britain with the work of Sir Archibald Geikie, then the local director of the Geological Survey's Scottish branch, among others. In 1863, Geikie had published a paper on the general glaciation of Scotland, in which he put forward his theory that the glacial drift in Scotland was the product of ice sheets 'like large tracts of Greenland in the present day' (p. iv), rather than of icebergs within a sea which had covered the islands, as had been the understanding to that point. Close must have read this, and in 1866 published a paper on the general glaciation of the Dublin area, and followed this the following year with 'Notes on the general glaciation of Ireland' in which he postulated the same origin for the Irish drift as Geikie had proposed in Scotland. This paper has stood the test of time, and has been cited over 70 times since its publication. Within its pages, Close outlined the pattern of glaciation that he understood to have occurred, based on the striae and drumlin evidence in Ireland. The flow lines Close produced within this work mirror closely those proposed by Quaternary scientists for Ireland in the late twentieth and early twenty-first century (figure 2).

Kinahan saw in Close's ideas an explanation for what he was mapping in Connemara, although initially Kinahan was somewhat reluctant to admit Close's ideas (Kinahan, 1870). Close visited Kinahan in West Connacht, and the pair together argued in their paper, which was published independently, that 'nothing remains but to account for the phenomena in question [the drumlins and striae] by the movements of a general covering of land ice of considerable depth; notwithstanding that there are some particulars of its behaviour, which cannot be easily explained. Such an agent, granting its existence and necessary great development, is clearly capable of producing all the phenomena of abrasion; and it has formed the drumlins by an operation evidently similar to that by which a stream of water often makes longitudinal ridges of sand in its bed' (Kinahan and Close, 1872, p. 11). Close's initial hypothesis of land ice covering Ireland and being responsible for its geomorphology was now gathering momentum.

However, even in this seminal work, the origin of the eskers was attributed to a marine influence, as, according to Close and Kinahan, there could be 'no question but that floating ice was moving about during the period of post-Pliocene submergence, when the washed and stratified (or esker) gravels of this district were formed. To no other agency can we refer the transportation of the far-travelled blocks of Galway granite into the Queen's County,

Limerick, Cork, etc., which blocks are frequently found lying upon water-formed drift' (Kinahan and Close, 1872, p. 9).

The collaboration between Kinahan and Close did not extend past this one important contribution to the understanding of glaciations in the late nineteenth century. Close went on to become president of the Royal Geological Society of Ireland between 1877-79. He was a leading member of the Royal Dublin Society, and was elected to membership of the Royal Irish Academy in 1867. Close also published works on astronomy and physics, although he used a pseudonyms of John O'Toole and Claudius Kennedy for these, perhaps because he did not feel his knowledge on these subjects was as developed as his knowledge of geology. He died at his rooms in Baggot Street in Dublin in 1903, leaving £1000 to the Royal Irish Academy in his will for the development of an Irish dictionary (Davies, 2004b).

After his collaboration with Close, Kinahan continued his work within the Geological Survey, although he was more interested in developing a name for himself as an independent geologist, publishing prolifically in geological magazines and journals throughout the 1870s. He succeeded Close as president of the Royal Geological Society of Ireland in 1880. From late 1870s Kinahan turned his attention to publishing books – his 'handy books', some of which he co-authored with other leading experts, were drawn from his addresses to the Royal Geological Society or other talks (cf. Kinahan, 1873, Kinahan and McHenry, 1882). Arguably, his best-known geological work was on the economic geology of Ireland (Kinahan, 1889), which first appeared as a series of papers in the scientific proceedings of the Royal Dublin Society, and which Kinahan later published as a book in 1889. The work remains a reference for those interested in the mineral resources of Ireland to this day. His 'manual on Irish geology' appeared the same year as a similar work by Hull, as the rivalry between the two men continued. Kinahan was elected as a member of the Royal Irish Academy (RIA) in 1867, Du Noyer being among those proposing him. Hull was proposed for membership of the RIA in 1876, with Kinahan as one of the proposers. However, he was not elected. Kinahan retired from the Geological Survey in 1890, and died at his home in Fairview, Dublin in 1908.

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