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The Down Survey of Ireland

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The 17th century 'Down Survey' resulted in the first systematic mapping of Ireland, with unprecedented levels of organisation and accuracy. It proved a milestone in Irish and world cartography and its maps were used as a record of land tenure almost until the advent of the Irish Ordnance Survey in the 1820's. Following a brief description of the historical context which brought about the survey, this paper investigates the planning, measurement techniques and instrumentation used by William Petty and his principal assistant, Thomas Taylor. The cartographic style of arguably Ireland's greatest survey is described and illustrated with a superb example from the collection of barony maps now kept in the Bibliothèque Nationale de France and from which, the first permanent Irish exhibition of Down Survey maps has been compiled.

Introduction

Henry VIII is reputed to have said that "Ireland must first be broken by war before it is capable of good government". Henry acceded to the English throne in 1509 and reigned until his death in 1547. His military control of Ireland was ineffectual however and confined to a fortified area of a few hundred square miles around Dublin known as the 'Pale'. The countryside outside the Pale was ruled by the native Irish and gaelicised 'old English' chieftains in a state of prevailing resistance to the spread of Crown rule.

Early attempts to extend military and administrative control beyond the Pale were unsuccessful. In 1534 for example, all lands in Ireland were required to be surrendered to the Crown under a royal decree. The confiscated lands were then to be granted back in exchange for an oath of allegiance to the king. Implementing such a policy was another matter and it was not until the accession of Queen Elizabeth I in 1558, that any sustained attempt was made to enforce English rule throughout the rest of Ireland. The gradual suppression of Gaelic resistance eventually allowed a greater degree of English control and influence in Ireland by the end of Queen Elizabeth's reign in 1603.

This period of history brought about the beginning of change in Irish land tenure which had been previously administered under the ancient system of jurisprudence known as Brehon Law.

Irish plantations

The plantation of Ulster was devised by King James I in 1606 as a method of extending English rule in Ireland. The idea of planting colonies of settlers had previously been tried in Leix/Offaly in the 1550's, in Munster in the 1560's and 1580's and again in Ulster in the 1570's. All



Fig. 1. Oliver Cromwell (1599 - 1658) by Samuel Cooper (National Gallery of Ireland)

had failed due to rebellion or inadequate funding. The 1606 plantation of Ulster was more successful, however. It was better planned and was the most systematic attempt yet to plant large numbers of settlers from England and Scotland.

The year 1641 saw the beginning of a great rebellion in the north of the country for the return of lands confiscated in 1601. The rebellion was particularly vigorous in Ulster which also had the largest concentration of settlers from the earlier plantation. Thus began the process of sectarian conflict and division in Ireland - a process which was furthered by the arrival in Ireland of General Oliver Cromwell (Figure 1).

Oliver Cromwell

Cromwell arrived with his army on the 15th of August 1649 following victory by the Parliamentarians over the Royalists in the English civil war. The objectives of the invading army were to crush the rebellion in Ireland and to eliminate any remnants of Royalist support on this side of the Irish sea. Striking first at Drogheda and then sweeping southwards, opposition quickly succumbed to Cromwell's superior military force and ruthless methods. The garrisons of several towns were put to the sword, causing others to flee in panic without a stand.

Following Cromwell's victory, draconian measures were quickly instituted to evict all 'Papist' land owners. They were forced either to migrate across the Shannon into the poorer lands of Connacht or else to go abroad, encouraged by a cash subsidy. An estimated 34,000 land owners and fighters accepted the latter offer and fled the country, many into Spanish military service [3].

With many of the Gaelic land-owning class now dispossessed, the peasant and labouring classes awaited the decree of the new government. The conquerors were about to regulate, replant and revive the country to its former flourishing condition.

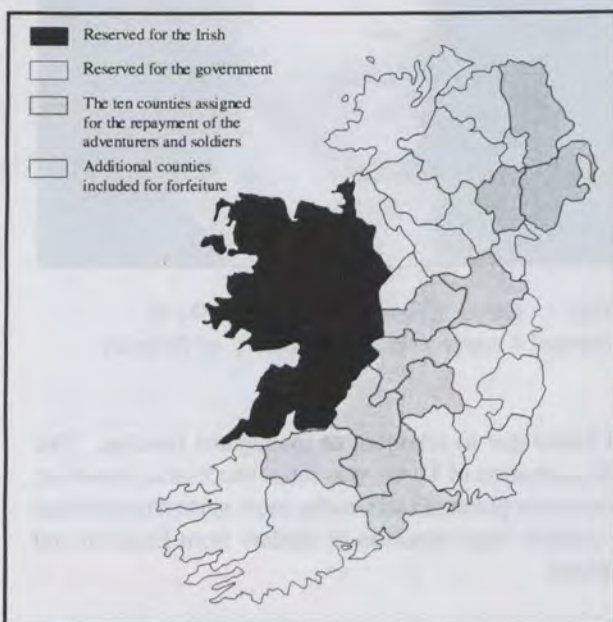


Fig 2. The Cromwellian settlement of Ireland (1652)

The Cromwellian settlement

The objectives of the Cromwellian Settlement were two-fold. The first was to confiscate circa 2.5 million acres of land as "*a godly retribution upon the barbarous wretches who had contrived the rebellion of 1641*". Cromwell's second objective was to repay his officers and soldiers and the many English politicians and merchants - the '*adventurers*' - who had funded his military campaign in Ireland. The Cromwellian army then consisted of a very large force of over 34,000 horsemen, dragoons and infantry. Increasing arrears of pay were generating costs of about £600,000 annually. To defray the mounting debt, the disbanded soldiers were to be paid in debentures of confiscated land rather than cash.

Following the Land Grant Act of 1652, the Government confiscated all the walled towns, Church property and estates belonging to 'Irish Papists' in Dublin, Kildare, Carlow and Cork. Land was additionally confiscated in ten other counties to repay the adventurers and Cromwell's officers and soldiers. Poor quality land in the west of Ireland was reserved for the dispossessed Irish (Figure 2). The percentage of land ultimately confiscated in each county would vary from as little as 4% in Co. Tyrone to 91% in Co. Galway [2].

Land distribution

The practical business of distributing the confiscated land would prove complex. The effect of twelve years of war had virtually ruined the country and it was impossible to obtain accurate information regarding land ownership. Although the decision to confiscate land had been taken in 1641, the ensuing war had prevented any attempt at valuation and surveying - an essential prerequisite to the process of distributing the confiscated land.

In the interim and amidst fears that the supply of land might run out or become devalued, many of Cromwell's soldiers disposed of their debentures to officers and astute speculators, eager to purchase land at bargain prices. This enabled some individuals to amass huge estates and established patterns of land ownership that would remain unchanged until well into the nineteenth century¹.

The task of distributing the confiscated lands was entrusted to a Government Commission established in June 1653. A Survey and Valuation was embodied in the Act, to speed the process of distribution. To carry out this work, Benjamin Worsley - a medical doctor by profession - was appointed Surveyor General of Land in 1653.

¹ Prior to the passing of the first Land Grant Act of 1870, all land was owned by just 3% of the population. That figure would grow to more than 70% by the foundation of the State in 1922, aided by a succession of Land Acts and Commissions which enabled tenants to acquire land holdings of viable acreage.



Fig3. Sir William Petty (1623-1687) by John Smith (National Gallery of Ireland)

Surveying in those days was not a complex science and would not have required any great deal of specialist knowledge. Worsley had high social status and interestingly, carried magnifying glasses, “by means of which he sought to impress a gullible and ignorant public with vast ideas of his scientific attainments” [7]. In this regard he succeeded but he failed to impress William Petty who had also arrived in the country for another purpose.

The arrival of William Petty in Ireland

William Petty was born in Hampshire, England in 1623 (Figure 3). He studied medicine and science at Oxford and had become a medical doctor and Professor of Anatomy by 1650. He accepted the post of physician-general to the army in Ireland in 1651. Petty travelled to Ireland in the company of Benjamin Worsley on board the frigate ‘Revenge’ in 1652.

Seventeenth century Ireland was a very unhealthy place for both the native population and invading army alike. Dysentery and other epidemic diseases were widespread. Petty’s primary task was to restructure and improve the medical service of the army. This he quickly did, demonstrating a genius for organisation which he would soon apply to an even greater task.

Probably as a result of his scientific background, Petty took an interest in the work of the Surveyor General. The survey and valuation of the confiscated lands had just commenced under Benjamin Worsley’s supervision. Worsley planned to survey only the land confiscated in the ten counties designated for repayment of the adventurers and soldiers, and did not intend to include the civil boundaries.

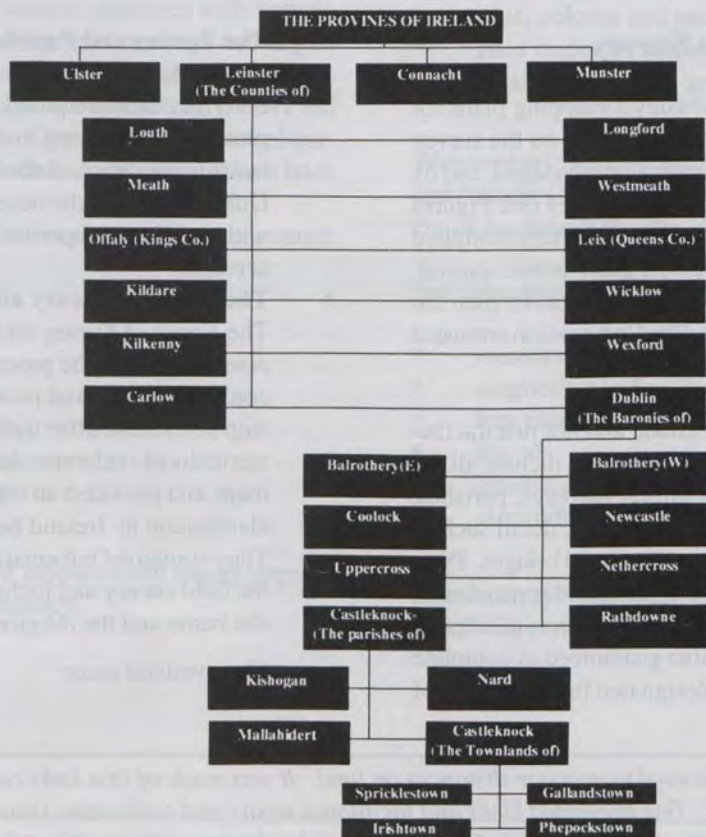


Fig. 4. Civil sub-division of Ireland in 1641 (part of)

2 District Electrical Divisions (DED) are now comprised of groupings of townlands whose present day boundaries are delineated on Ordnance Survey maps.

Civil Boundaries

Ireland is divided into four provinces and thirty two counties, with further subdivision into baronies, parishes and townlands. These civil sub-divisions originated in the Christian era when Ireland was divided into one hundred and fifty kingdoms known as 'Tuatha' occupied by autonomous groupings of families ruled by a king [2]. From the 12th century onwards, the sub-division of land under the control of the Normans, like Sir Maurice de Prendergast for example, saw the creation of counties, similar to the shires of England. Baronies were parcels of land held by feudal tenant-in-chiefs and granted directly by a king. Together with counties and townlands, such units provided a hierarchical administrative structure for collecting taxes and census data to underpin the colonising process.

To illustrate the above, the province of Leinster, for example, was divided into twelve counties (Figure 4). County Dublin was further subdivided into seven baronies with the barony of Castleknock, for example, sub-divided into four parishes (see also Figure 7). The parish of Castleknock was subdivided into four townlands. A townland is the smallest unit used for civil administration and defined as a parcel of land which is larger than a field but smaller than a parish².

The Down Survey

Petty was highly critical of Worsley's mapping plans for several reasons - the proposed rates of pay on the survey were too high, no accuracy checks were envisaged, and by omitting the civil boundaries from the survey (see Figures 4 & 7), the proposed plan would not have fully complied with the 1652 Act. As a result of a bitter public quarrel, Petty was summoned to present his alternative plan for mapping the confiscated lands to the Commission entrusted to administer the Act.

Petty proposed that the whole island and not just the forfeited lands should be surveyed. He would include all the civil boundaries (provinces, counties, baronies, parishes, townlands and plowlands) and topographic detail such as rivers, mountains, lakes, bogs, dwellings and bridges. Petty proposed to charge £7-3-4 for every thousand acres of profitable land surveyed and £3 per thousand acres of unprofitable land. Significantly, he also guaranteed to complete the survey of the ten counties designated for repayment of

the adventurers and soldiers in under two years, whereas Worsley's proposed to take 13 years. In addition, Petty promised that Cromwell's soldiers would be given ownership rights to parcels of land, supported by maps at a scale of '40 perches in an inch' (see Table 1).

While Worsley and Petty did not disagree on the method of the survey, they argued fiercely on matters of organisation, costs and completion dates. Petty's superior plan was eventually approved by the Government but with some supervision by Worsley. The Commission finally decided on October 16, 1654 "that the lands to be set out for the payment of the armies arrears and the other public debts, be surveyed down as proposed by Dr.Petty".

The most systematic survey of Ireland was about to commence and would become known as the 'Down Survey', a term adopted by Petty himself and meaning simply that all measurements were to be plotted down on paper. The contract was signed on December 11, 1654 and the task began on February 1, 1655.

The Down Survey consisted of:

- **The Civil Survey**
The civil survey proceeded ahead of the mapping to identify the lands to be mapped, classify them as profitable or unprofitable and to establish the identity and religion of the owners [6].
- **The Barony and Parish Maps accompanied by the Books of Reference**
Petty's contract required him to deliver 'perfect plots' of each barony and parish in the forfeited lands to the office of the Surveyor General in Dublin, showing the necessary civil subdivisions with details of proprietors names, religion and acreage.
- **The Books of Survey and Distribution.**
The Books of Survey and Distribution were an essential part of the process of distributing confiscated land and provided a record of ownership before and after forfeiture. They were meticulously referenced to the accompanying maps and provided an official record of land distribution in Ireland between 1656 and 1702. They contained information derived mainly from the field survey and included:
 - the name and the religion of Priorietors in 1641
 - the townland name.

³ The Surveyors Chain was used to measure distances on land. It was made of iron links connected to each other by small elliptical links. This prevented kinks and facilitated repair and calibration (standardisation). The total length of the chain was usually 100 links (80 chains = 1 mile) and tally marks were often fitted at regular intervals to simplify distance measurement. Link length depended on the measure and standard of the time but would have been approximately 8 inches or 213mm. Brass handles were fitted at either end to enable it to be pulled taught for measurement purposes. It was used with conjunction with the circumferentor which measured angles and magnetic bearings

- the townland name.
- land quality (profitable or unprofitable) and acreage
- the name of new proprietor following confiscation

Nothing on this scale had previously been undertaken in Ireland. Sir Thomas Wentworth (Earl of Stafford) who was Lord Deputy of Ireland in the 1630's during the reign of Charles I, had previously commissioned surveys in Tipperary and Connacht. Petty is known to have studied these maps and learned from Lord Strafford's techniques.

Survey planning and organisation

Petty now commenced the mammoth task of selecting and training a force of about one thousand men to carry out and complete the work of the survey to the agreed deadline. His principles of organisation were revolutionary. Although only 31 years of age at the time, he demonstrated his genius both as an administrator and surveyor.

Forty clerks were to be kept at the survey headquarters in Cork Hill, Dublin and the remainder were to be specially trained as field surveyors and assistants. Petty appointed district surveyors, some of whom attended lectures in military cartography at Trinity College Dublin [1]. Foot-soldiers were trained to measure distances with surveyor's chains³ and observe magnetic bearings and angles using an early type of circumferentor (Figure 5), the precursor of the modern theodolite. Interestingly, Petty did not recruit from the ranks of the many professional surveyors of that time, for reasons which are explained later.

Petty divided the task of surveying into the constituent tasks of :

- field surveying
- protracting
- casting
- reducing
- ornamating the maps.
- writing and examing

This innovative division of labour would ensure unprecedented efficiency and accuracy.



Fig 5. Circumferentor (1688) by John Lewis, (St. Patrick's College, Maynooth)

Materials and Instrumentation

The following materials were imported from London for the survey:

- scale, protractors and compass cards
- magazines of Royal paper
- glue, colours and pencils
- field books of uniform size
- small French tents and portable furniture.

Wire-makers, watch-makers, wood turners, pipe makers and founders were recruited to manufacture a wide variety of equipment for the survey.

Instrumentation included:

- measuring chains
- magnetic needles
- box cases for the compasses
- tripods
- brasswork
- circumferentors

Interestingly, only workmen "of sensitive head and hand" were allowed to assemble the compasses.

⁴ The oldest is a wooden circumferentor made in Dublin in 1667 and now kept in the Museum of the History of Science, Oxford.

⁵ The fleur-de-lis was the heraldic bearing of the royal family of France. It resembles the 3 petals of an iris, tied by an encircling band.

The circumferentor illustrated in Figure 5 is the oldest known signed instrument in Ireland and second oldest known⁴ [4]. It was made in Dublin by John Lewis in 1688, just after the ending of the Down Survey and probably typical of the type used by Petty's surveyors.

This instrument has three main components:

- **The Face**
The centre of the face would have carried the freely moving magnetised needle, mounted on a central pin. The face also carries:
-an engraved rose motif
-the inscription "*Johannes Lewis Dublini Fecit anno Domini 1688*"
-a 16 point compass with the mid quadrant points indicated by the large half hatched triangles. The remaining points are indicated by smaller half hatched triangles. Cardinal directions are annotated anticlockwise from north. North is represented by a fleur-de-lis⁵, a style consistent with that used on the Down Survey maps (Figure 7).
- **The Circle**
The raised circle is graduated every 30 minutes of arc and numbered every 10 degrees, incrementing clockwise from 10 degrees to 360 degrees.
- **The Base Plate**
This carries the raised circle and face and has two projecting holed lugs, one of which is marked with an 'X'. These would have carried the vertical sights for aligning to any feature or object. The graduation method on the circle suggests that 'X' indicated the eye sight end. Thus a clockwise rotation of the sights by 90 degrees for example,

would bring 'E' underneath the north end of the compass needle to give a magnetic bearing of 90 degrees.

Fieldwork and map production

Although used to hardship and drudgery, Petty's surveyors had to endure extensive travel, inadequate diet and severe weather. They also had to be "*fit for leaping hedges and ditches*" and skilled in self defence. In October 1655 alone, eight of Petty's surveyors were killed by those opposed to Cromwell's re-settlement scheme. This fact would seem to vindicate Petty's earlier refusal to employ professional surveyors.

The civil boundaries were '*admeasured*' or surveyed by traversing and then plotted on grid paper. Acreage belonging to the different proprietors was then calculated in acres, roods and perches by counting the number of grid squares in each property. The results were meticulously listed in the 'Books of Reference' which accompanied the final maps (Table 2).

The maps were scrutinised by examiners who were "*astute and sagacious persons*", recruited to detect any fraud in the measuring or plotting. Thomas Taylor was Chief Surveyor and Examiner on the Down Survey with an annual stipend of £100.

By April 1657, the confiscated lands in the ten counties were surveyed. Maps were drawn and then reduced to a size suitable for binding into volumes. Petty wisely put a time limit of one year on liability for errors. He personally superintended the distribution of some of the confiscated lands and by 1658, Petty's first contract was finished.

Map Classification	Plot Scale	Equivalent Scales
Barony Maps	'40 perches in an inch'	8 inches to 1 mile or 1:7,290
	'80 perches in an inch'	4 inches to 1 mile or 1:15,840
	'160 perches in an inch'	2 inches to 1 mile or 1:31,680
	'200 perches in an inch'	1.6 inches to 1 mile or 1:39,600
	'320 perches in an inch'	1 inches to 1 mile or 1:63,360
Parish Maps	'40 perches to an inch'	8 inches to 1 mile or 1:7,920
	'80 perches to an inch'	4 inches to 1 mile or 1:15,840

Table 1. Map Classification of the Down Survey.

⁶ For a discussion on units of measurement and standardisation, see under *Plantation Measure in Plantation Acres* [1].

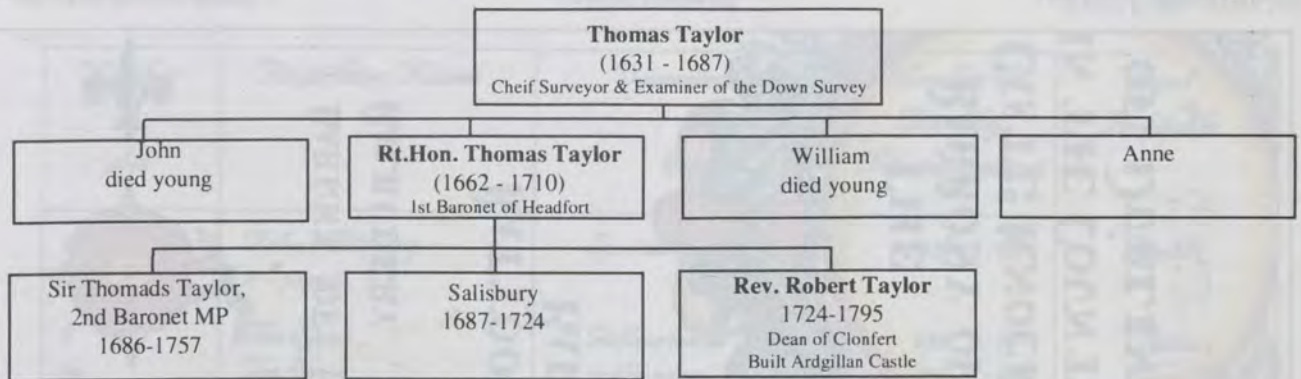


Fig 6. Taylor Family Tree (part of)

Map legacy

The Down Survey maps consist of a total of 1430 maps drawn at various scales (Table 1). Of these, 216 are barony maps covering most of the country with the exception of counties Galway and Clare. The remainder are parish maps.

Over the intervening centuries, many of the original maps have been lost or destroyed. Some have survived, including a bound volume originally retained by Thomas Taylor at Headfort House near Kells (now a boarding school). Those maps are now kept in the National Archives, Dublin. Importantly, a complete set of barony maps which were the property of Sir Henry Petty (Baron Shelbourne), the youngest son of William Petty, were seized by the French on 22nd February 1707 from the English ship the 'Unity' bound for London. Those maps were presented to the King of France by M. de Velincourt, Secretary General of the French Navy in 1709. That complete set is now in the possession of the Bibliothèque Nationale de France.

The Down Survey maps & Ardgillan Castle

A permanent exhibition of reproductions from the Paris collection was recently opened at Ardgillan Castle in north County Dublin. Located in one of Dublin's regional parks, the Castle was originally built in the style of a manor house by the Rev. Robert Taylor in 1738. Robert was a grandson of Thomas Taylor, the Chief Surveyor and Examiner of the Down Survey [5] (Figure 6).

This unique exhibition of Barony Maps was assembled with the assistance of a FAS Heritage Project. The exhibits were obtained from the *Bibliothèque Nationale de France* and are printed in full colour and to scale.

The Barony Map of Castleknock

The Barony map of Castleknock, County Dublin - featured in the Ardgillan Castle exhibition and illustrated in Figure 7 - portrays the cartographic style of the period and reveals details of land ownership in early 17th century Ireland.

Information contained in this map includes:

- **The Cartouche (or decorative panel)**
Described as a red rose with leaves and stem, it shows the name of the county (Dublin), the name of the barony (Castleknock) and the surveyor's names (George Baldwin & Robert Girdler). The date of the map is not shown but it would have been drawn *circa* 1657.
- **Scale**
The scale is '160 *perches* in an inch' and is also graphically shown.
- **Orientation (Ordnance Point)**
The north cardinal direction (magnetic) is represented by a blue fleur-de-lis, attached to a decorated circle containing a red rose motif with leaves and stem. The motif style varies from map to map but is commonly a star, a compass or a flower. The east, south and west cardinal directions are indicated by letters.
- **Topographic detail**
The location of domiciles, churches and castles are represented by symbols.
- **Civil Boundaries**
Barony names are written in the largest font size in bold capitals and coloured black. Barony boundaries are in-lined with green ink. Adjacent baronies are named and their intersections with the Barony of Castleknock marked by a cross symbol. Parish names are written with a smaller font size and coloured red. Parish boundaries are differentiated by in-lining using a variety of colours - yellow, blue or pink etc.

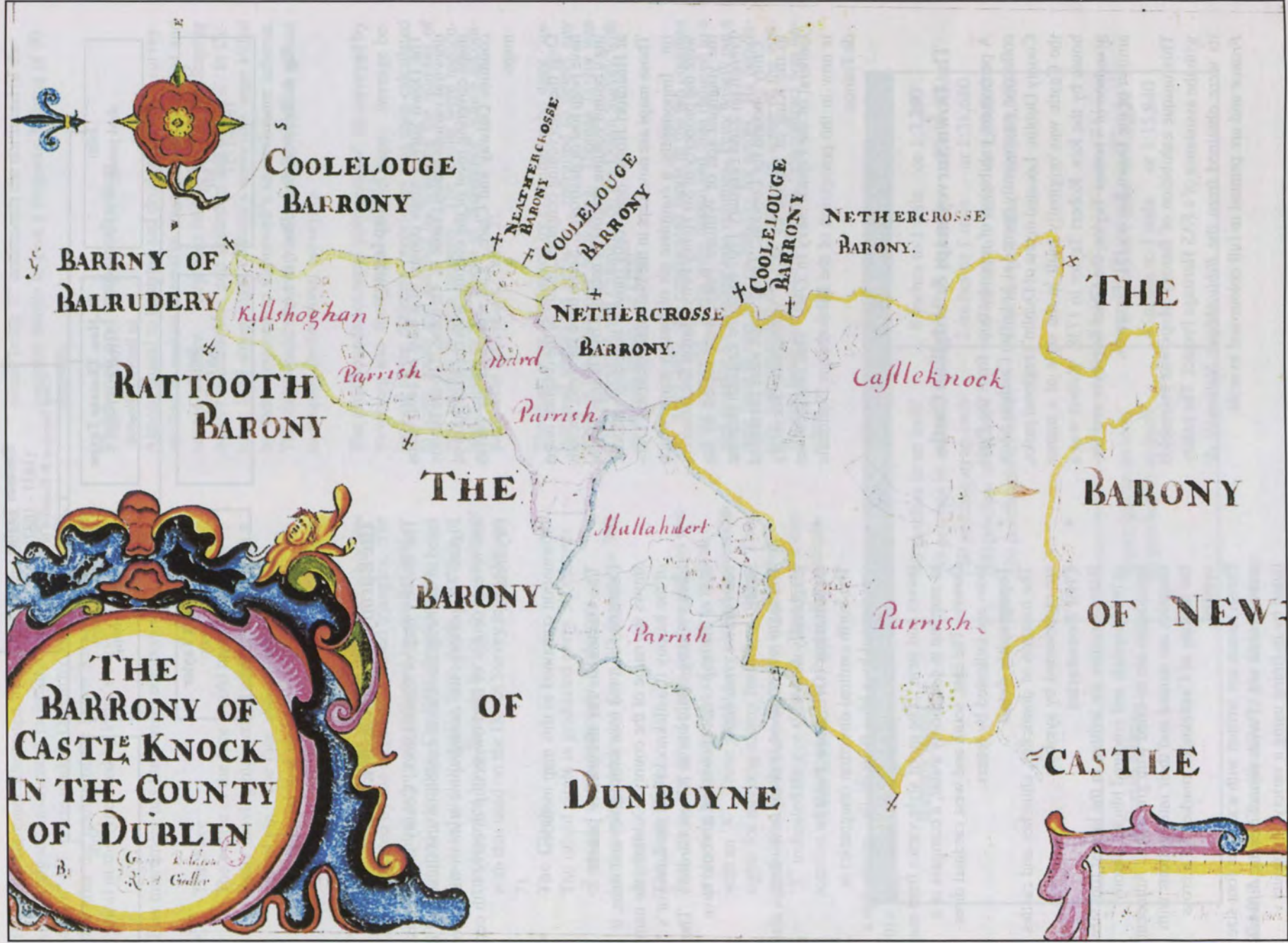


Fig.7 Barony map of Castleknock, Co.Dublin (Ardgillan Castle Exhibition & Bibliotgeque Nationale de France)

<i>Number in plot</i>	<i>Proprietors Names</i>	<i>Denomination of Band</i>	<i>Number of Acres by Admeasurement</i>	<i>Band Profitable</i>
1	<i>Robert Fitzgery ir - papist</i>	<i>Sprickhestonne</i>	<i>033 : 2 : 20</i>	<i>Arable</i>
2	<i>The Same</i>	<i>Sallenstonne</i>	<i>088 : 2 : 00</i>	<i>Pasture</i>
2 ^o	<i>The Same</i>	<i>in the same</i>	<i>009 : 1 : 00</i>	<i>Shrub Wood</i>
3	<i>John Dalehide ir - papist</i>	<i>Irishstonne</i>	<i>076 : 0 : 16</i>	<i>Arable</i>
4	<i>The Same</i>	<i>Phapochstonne</i>	<i>083 : 1 : 20</i>	<i>Arable Pasture</i>
4 ^o	<i>The Same</i>	<i>in the same</i>	<i>013 : 1 : 00</i>	<i>Shrubby Wood</i>
	<i>Sir James Ware protestant</i>	<i>303 : 0 : 00</i>		
	<i>The Total of fortified Bands is</i>		<i>324 : 0 : 16</i>	

Table 2. Abstracted from the 'Book of Reference' for the Parish of Ward in the Barony of Castleknock in the County of Dublin



Fig 8. William Petty's Map of Ireland 1685 (Marsh's Library)

Townland names are written with the smallest font size and coloured black.

- **Land Ownership & Forfeiture**

The numbers shown in each parish (see Figure 7 and column 1 of Table 2) identify 'Irish Papists' who owned land. Their identity, townland, the quantity of land measured in acres, roods and perches⁶ and whether the land was profitable or unprofitable are tabulated in the remaining

columns of the 'Book of Reference'. Significantly, land owned by protestants such as Sir James Ware for example, is excluded from the summated total of forfeited land in Ward parish.

Petty's Atlas of Ireland

Petty's contract also required him to produce additional smaller scale maps of the whole island for public use and convenience. Prior to the Down Survey, coastline maps showed little detail and were based upon incomplete information supplied by sea faring traders rather than on actual measurement. Petty's innovative outline map of Ireland was created from a mosaic of county maps derived in turn from mosaics of the parish and barony maps. Importantly, this yielded the first realistic map of Ireland (Figure 8).

The results were published in 1685 bound in an atlas entitled '*Hiberniae Delineatio*' and contained thirty six maps consisting of:

- an outline map of Ireland,
- four provincial maps,
- thirty one county maps depicting the baronies.

That atlas is now kept in Marsh's Library, Dublin.

Summary

The Down Survey is regarded as the first systematic survey of Ireland. In their day, its maps are claimed to have been the most exact ever made with average errors ranging from $\pm 2\%$ to $\pm 11\%$ (Andrews). They formed the basis for the legal record of title for much of Ireland, virtually until the creation of the Ordnance Survey in the 1820's. The maps and accompanying books of data are now an invaluable resource for those studying the social history of 17th century Ireland.

Arising from the Down Survey, William Petty and Thomas Taylor are now arguably two of Ireland's most important surveyors. Ardgillan Castle was built by the grand-

son of Thomas Taylor - the Chief Examiner of the Down Survey. The castle is located in Ardgillan Demesne and has appropriately become the permanent home for this magnificent public exhibition of facsimile Down Survey maps.

While the motives behind the efforts of Petty and Taylor on the greatest of the plantation surveys are better consigned to history, the monumental importance of this milestone in Irish cartography does not deserve a similar fate. Arising from the creation of this permanent exhibition, the words of William Petty written more than 300 years ago may prophetically see his efforts "*be of lasting advantage to the nation*".

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