

# Historical seismicity of the Faroe Islands

Roger M.W. Musson<sup>(1)</sup>, Tina Mikkelsen<sup>(2)</sup> and Heri Ziska<sup>(2)</sup>

<sup>(1)</sup> *British Geological Survey, Edinburgh, U.K.*

<sup>(2)</sup> *Geological Department, Faroese Museum of Natural History, Tórshavn, Faroe Islands*

## Abstract

A study is presented of the historical seismicity of the Faroe Islands, an area of low seismicity where no previous search for historical earthquakes was ever made. This presents a novel problem, since most studies of historical seismicity usually have previous catalogues to use as starting points. In this case the only information available at the start of the study related to a short sequence of small events in 1967 and two newspaper reports from the 1920s-1930s of strange phenomena which could be discounted from being earthquake related. The methodology of researching historical seismicity from scratch is described in detail. The results of the study were that no genuine historical earthquakes were found. However, in the first case, the fact that no events were found indicates that the lack of historical events in the Faroes is real and not just a function of no-one ever having looked for them before. In the second case, a positive statement (from 1906, in connection with a spurious earthquake report) was found that no earthquakes were known ever to have occurred in the Faroes. This means that two types of argument can be adduced: that there is no evidence that there were earthquakes (argument from the negative), and that there is evidence that there weren't earthquakes (argument from the positive). Taking into consideration the historical and cultural factors, some limits are drawn up for the probable extent to which one can rule out the occurrence of earthquakes of different intensities for different time periods.

**Key words** *historical seismicity – Faroe Islands – low seismicity areas – data gap*

## 1. Introduction

The Faroe Islands (located at latitude 62°N, longitude 7°W, between Scotland and Iceland) are in an area of very low seismicity; looking at any published earthquake map reveals almost a total absence of regional seismicity. However, because of possible undersea slope stability problems, even low levels of seismic activity in the waters between the Faroes and the British Isles are of concern to those involved with offshore

hydrocarbon exploration. The question therefore arises, if no investigation of Faroes seismicity has hitherto been made (coupled with the difficulty of observing offshore seismicity), should the seismicity of this area be characterised as unknown rather than low?

In order to attempt an answer to this question, a study was launched by the British Geological Survey and the Faroese Museum of Natural History on behalf of the Faroes GEM Network to examine the historical records of the Faroe Islands, with two complementary aims: firstly, to look for accounts of historical earthquakes in the area that have previously been overlooked; secondly, failing that, to demonstrate the absence of earthquakes in the historical record. The second aim calls up a general problem of scientific or even historical method: the difficulty of proving a negative. Even in areas that are

*Mailing address:* Dr. Roger M.W. Musson, British Geological Survey, Murchison House, West Mains Road, Edinburgh EH9 3LA, U.K.; e-mail: R.Musson@bgs.ac.uk

close to being aseismic, it is still necessary to address issues of seismic hazard to prove that the level is low (Richardson, 1975; Musson, 1998). Because of the unusual nature of the problem, this paper describes the methods employed in some detail; the methods and the historical and cultural background are important to grasp in full if one is going to interpret the results (which are, on the surface, very limited).

The investigation of historical seismicity in areas of very low seismicity presents an essentially different set of problems to the more common case of such studies in high or moderate seismicity areas (Musson, 1998). Even in an area such as the U.K., a well-defined path to completing an earthquake catalogue can be established. The starting point is the existence of previous compilations of earthquake lists produced by antiquarians or early seismologists. These may be flawed and incomplete, but they provide an initial list of dates and places that can be used to check original sources against. This yields up primary source material from which evaluations of the earthquakes can be made, but these source data often contain comparisons and recollections of further earthquakes which supply additional dates for checking. A chain of references gradually builds up from the initial working list, and more and more earthquakes can be discovered in such a way, leading to a more and more complete catalogue. Procedures for historical investigation are discussed in numerous sources, of which one might mention Magri *et al.* (1987), Eisinger *et al.* (1992), Stucchi and Camassi (1997) as well as many more papers related to more specific case studies.

By way of contrast, in the situation of the Faroes one starts with practically nothing. A survey of the pre-existing information of Faroese earthquakes (Musson and Ziska, 1998) found one small sequence of earthquakes in 1967 (shown in fig. 1) and two spurious or unexplained reports from earlier years. Any other documents that had been examined at this stage that might be expected to allude to any historical events (for example, the natural histories of Debes 1676 and Landt 1810) make no mention of earthquakes at all. One is therefore faced with the totality of recorded information about the history of

the Faroe Islands with no place to start. The examination of every letter and every log book and every other manuscript or printed document in the off chance that it might mention an earthquake is totally impractical. It therefore becomes necessary to devise a strategy that maximises one's chances of discovering something (should it exist) while keeping the time required within practical limits (Vogt, 1993).

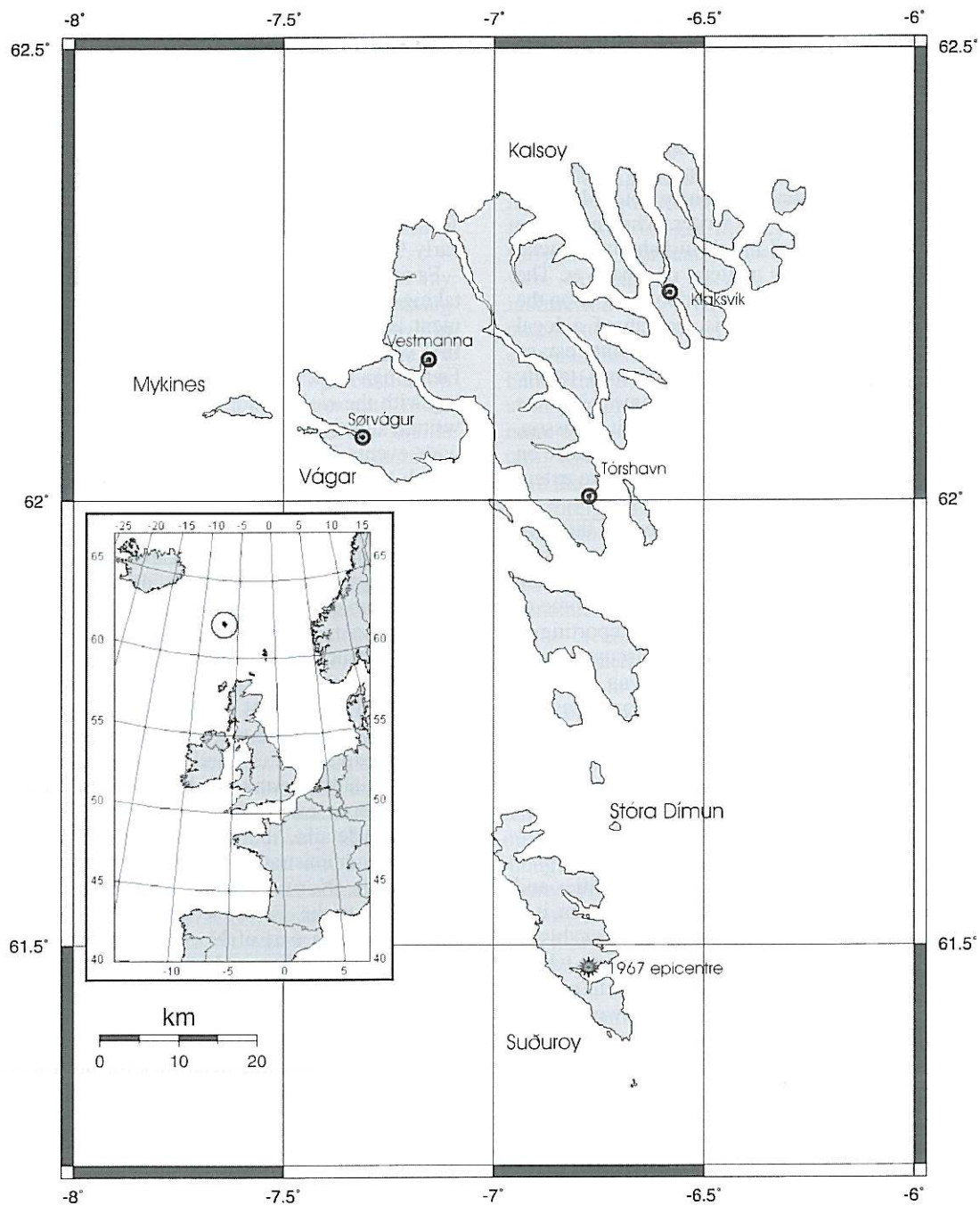
Such a strategy has three main elements:

- Use secondary sources as a distillation of primary sources.
- Take advantage of the experience of others.
- Scrutinise key primary records.

The ideas behind such a strategy are as follows. A large amount of the existing archival material on local history (here of the Faroes, but the principle often applies) will already have been examined by other researchers, especially historians and antiquarians, and the more inherently interesting the material, the more likely it is to have been worked over. Therefore there is a good probability that secondary sources on local history will make reference to any unusual occurrence that the author came across while working through the primary documents. This is particularly the case with works written before the 20th century, as it was common then for antiquarians to attempt to write «complete» local histories in which natural history and social history were presented together. Later on, historians became more specialised in their interests. But even if a modern historian working on local history has only specific themes that they want to write about, it is likely that something so remarkable as a historical earthquake in a low seismicity area would at least stick in their mind so much that they would be able to recall it. Therefore it is valuable to speak to local historians who have already worked with collections of papers, and ask their advice as to the possibility that references to earthquakes might exist. If the historian replies along the lines of «I worked through the [insert name here] material and I am sure that if there was any mention of an earthquake then I would have noticed it», then a whole collection can be considered as being of low priority.

Finally, some types of document are so likely to include reference to an earthquake if any





**Fig. 1.** Map of the Faroe Islands showing the location of places mentioned in the text, except for those shown in fig. 3. The position of the 1967 earthquake sequence is shown. Inset: general location of Faroe Islands (circled).

occurred that it is essential to check them thoroughly. This principally applies to documents which have some responsibility to mention any earthquake. Suppose an earthquake occurred on such-and-such a date and a collection of correspondence exists that covers that date. The collection may contain a letter mentioning the earthquake, or it may not. It depends on the character of the writer, who may have only been interested in writing about financial matters, or religious matters, or whatever. The writer is not under any obligation to mention the earthquake. However, it is the job of a local newspaper to report matters of local interest; so if an earthquake occurs, other than a totally trivial one (and even then, sometimes) it is the *job* of the local newspaper to report it (Musson, 1986). Thus we place a very high importance on examining local newspapers, even to the extent of searching through entire runs.

The above account gives a view of the general ideas with which this study was approached. The next section presents a background setting of the history of the Faroes to illustrate some of the conditions that might affect the reporting of earthquakes. The third section discusses how the strategy described above was actually implemented, and the fourth section gives the results.

## 2. Historical background of the Faroe Islands

In order to understand the opportunities and limitations of historical study in the Faroes, it is necessary to know something of the basic history of the islands. As this is a subject with which most people outside the Faroes will not be very much acquainted with, it is worthwhile making some comments here. This section is based mostly on the work of Schei and Moberg (1991).

The earliest definite mention of the Faroe Islands appears in a work by a 9th century Irish monk, the *Liber de mensura orbis terrae* of Dicuil (Tierney, 1967). This work was composed in 825 and gives a description of islands two days' and two nights' sailing from the north of Britain which refers unmistakably to the Faroes.

Dicuil states that the islands have been inhabited by Irish monks seeking obscure hermitage for about the last hundred years. Archaeological evidence suggests that the first occupation was even a little earlier, in the first half of the 7th century (Jóhansen, 1974). However, even by the time of Dicuil it seems that Norse raiders had wiped out the early Irish settlement in the islands. The Norse settlement of the islands began in the early 9th century, and although there is a saga – *Færeyinga Saga* – that deals with the «land-taking» of the Faroes, the early Norse settlement is not nearly so well documented as the first colonisation of Iceland (Johnston, 1975). *Færeyinga Saga* is the only written source dealing with the early history of the Faroes; it was written shortly after 1200 and deals principally with events between 980 and 1040 (approximately). The author seems to have been an Icelandic who probably never even visited the Faroes (his geographical knowledge of the islands is weak). As a source for mundane events such as earthquakes, the saga is inadequate, and there are no other records that might be considered equivalent to the monastic chronicles from which so much knowledge of the seismicity of Europe in the medieval period has been drawn.

The few documents surviving from the later medieval period are (as is usually the case) administrative in nature, and it becomes the task of the social historian to make what deductions he can about everyday life and events from legislative details. At this period the Faroes were under the administration of the King of Norway; in 1380 the Norwegian and Danish dynasties merged, but the Faroes continued to be administered as a part of Norway. In 1536 both Norway and the Faroes became Danish provinces. At around this time the coming of the Reformation also had a profound cultural impact, as Danish replaced Latin as the language of the church. It then became necessary for ministers to be educated in Copenhagen, which strongly increased the Danish influence on Faroese culture. The population must have been small; and any sort of stability of life was made difficult by the frequency of destructive pirate raids (the predators including even Algerian pirates). Between 1500 and 1700 political power became more and more entrenched in Danish hands,



while trade was undertaken as a monopoly conducted for the personal benefit of an appointed governor. When, in 1709, the trade monopoly was taken over directly by the Danish crown, economic conditions improved but the move only increased the Danish cultural dominance. In the 1790s the Latin school in Torshavn was closed down, so that anyone seeking an academic education had to go abroad (usually to Denmark).

In 1814 the union of Denmark and Norway was finally dissolved, with the Faroes remaining as Danish. Even at this date, many of the laws in force in the islands were still Norwegian and not Danish. The Danish parliamentary constitution did not come into force in the Faroes until 1849. But perhaps one of the most significant events was the ending of the trade monopoly in 1856. This did more than anything else to open up the Faroes to the outside world, and trade and communications go hand in hand.

Faroese nationalism became important in the late 1880s; initially this was a revolt against the dominance of the Danish language over the Faroese language, but in time developed into a political movement for home rule. This was accelerated by the events of the Second World War; after Denmark was invaded by Germany, the Faroes were occupied by the British to prevent them being used as a German base. The British had no interest in maintaining the Danish administration nor in providing one of their own, so the Faroese were effectively allowed to manage themselves. After the war, a return to the *status quo ante bellum* was not seen to be practicable, so after a referendum in 1946 a Faroese Home Rule Act was introduced with effect from 1948. Since then, the Faroes have been a self-governing community within the Danish Realm, sharing the same currency but with enough independence to opt out of joining the European Community when Denmark joined.

The population of the islands has always been small. Today the population is about 50000, about 15000 of whom live in the capital, Torshavn. In 1930 the population of the islands was only about half of today's figure. Although in most people's minds the Faroes are associated with the fishing industry, this is actually a

relatively modern development in terms of its economic importance, dating back to the late 19th century only. Throughout historical times the principal economy was agriculture. The amount of land available for arable farming was, of course, rather limited, and this led to a settlement pattern of small, self-sufficient hamlets (*bygdir*) scattered around the landscape. Perhaps surprisingly, literacy was high even as early as the 17th century (Debes, 1676) as people were expected to be able to read the Bible; instruction was frequently passed on from parents to children (with regular schools for all communities becoming the norm in the second half of the 19th century). However, the language used in church affairs was Danish, and Faroese more or less did not exist as a written language until 1846, and was not used in church services until the 20th century. Thus literacy only existed in a foreign language, and since people learned their Danish from the Bible, their attempts to express themselves in Danish usually resulted in rather stilted phrasing. Such a situation, economically and educationally, is not conducive to the creation of large amounts of everyday written material such as diaries and journals. This sets a limitation on what can be expected in terms of source material for earthquakes in the historical period.

The predominant source of writing about everyday affairs in the islands in historical times tends to be found in accounts left by the ministers. These were few in number, even though almost every *bygd* had its own little church. For a long while the islands were served by only six ministers (today there are nineteen plus a bishop) each of whom was responsible for several churches; although a number of stand-in laymen were employed to read the service when the minister could not attend.

As discussed in the previous section, newspapers are a data source of critical importance for studies of historical earthquakes (see also the extended discussion in Musson, 1986). This is all the more true in areas where the seismicity is fairly low. In high seismicity areas where earthquakes may cause heavy damage, there are many types of document which may reflect the impact of the earthquake in terms of the disruption of normal life. Repairs to buildings may be

accompanied by accounts of costs, provision of relief for homeless families will need official documentation, and so on. If a severe earthquake of this nature had occurred in the Faroes, certainly any time from the 17th century on and perhaps in the 16th century, then even given the historical conditions described above, one would expect the event to be preserved for certain. One can look for preservation of records of comparable disasters and find them; for example, the avalanches that struck part of Klaksvík with fatal results in 1745 and 1765, or the one in 1809 that led to the abandonment of Blanskali on Kalsoy (Schei and Moberg, 1991).

However, where one is primarily expecting earthquakes of not very high intensity (because from experience within living memory the Faroes are clearly not a highly seismic area) then the sort of document that might be expected to record such events is rather limited. The local newspaper is pre-eminent here, because earthquake shaking of intensity 5 or even 4 is a remarkable occurrence in an area of low seismicity; therefore it is newsworthy; therefore it is the job of the newspaper to record it. And while manuscript letters and diaries are more often destroyed than kept, it is normal for files of old newspapers to be preserved.

In some countries such as the U.K., newspapers began to be published regularly from the beginning of the 18th century, or, to a limited extent, even earlier. In the Faroes the first ever newspaper was not published until 1852. This was *Færingetidinde*, a Danish-language paper (of course) devoted principally to political dissent, and fined out of existence after only nine issues. Thus continuous newspaper publication in the Faroes did not start until 1877, with the Danish-language *Dimmalæting* (Dawn) which is still published. It gradually adopted the Faroese language for news reporting during the 20th century, but still contains some material in Danish. The oldest Faroese language newspaper began in 1890 but folded in 1901. Currently there are eight newspapers published in the Faroes, which, with the exception of *Dimmalæting*, are all 20th century creations. Publication (even of *Dimmalæting*) tends to be twice or three times a week, rather than daily or weekly.

### 3. Searching for earthquake records

There are two main sources of historical information in the Faroes: the National Archives and the National Library. Two other possible sources were considered: the Natural History Museum itself (which contains a very small amount of archival material) and the Department of History at the University of the Faroes. These will be considered in turn.

#### 3.1. *The National Archives*

The National Archives were established in 1932, and store both public and private material, including the archives of the Faroese Parliament, civil records, company records, and so on. The earliest document dates to 1298 (this is the famous *Seyðabrevið* or Sheep Letter, the earliest administrative record for the islands) but most material is much later than this. Law books detailing matters coming before Parliament start in 1614. The earliest type of record kept on a day-to-day basis is the series of hand-written Police log books for Torshavn which start in 1785 and run to 1901. There are many miscellaneous collections of manuscripts. In 1994 it was estimated that the total collection of the archives occupied about 4600 m of shelf space.

The archives are not particularly well provided with detailed calendars of collections (summarising the contents of material), which also means one cannot expect a comprehensive subject index to exist. Since it would not be cost-effective to mount a major search through the collections (even the more promising ones, such as the Police log books), particularly since specialised palaeographical help would be required, it was decided that the best way to cover the material was to contact other researchers who had worked with the collections in order to get an indirect opinion of whether any references to earthquakes might exist. Also, as discussed above, the work of antiquarian writers who have used the old manuscripts in the past provide another indirect way to cover these records.

It also has to be remembered that it is very unusual for the sort of material normally



preserved in archival collections to have any reference to earthquakes unless serious damage or disruption occurs. Legal, financial and political documents usually make up the vast majority of the records that people have found worth preserving.

### 3.2. *The National Library*

The National Library is located in the same building as the National Archives. It was founded in 1928 and is the major collection of books, newspapers and magazines in the islands. Its holdings comprise about 135 000 books, 200 000 magazines and 500 reels of microfilm.

Two parts of the holdings are of particular interest to this study: firstly, books dealing with the general history or natural history of the Faroes, particularly those with a broad scope (more commonly found in writers working before 1900); secondly, the collection of Faroese newspapers. As discussed above, the main Faroese newspaper, and the earliest established one, is *Dimmalæting*. The National Library holds a complete run of this newspaper from 1877 onwards, on microfilm. A total of nineteen other titles also have runs preserved on microfilm; the earliest of these is *Tingakrossur*, which starts in 1901 and runs until 1990, but is not complete, there being several gaps. The second earliest title for which there is a complete run is *Sosialurin*, which has an unbroken run from 1927 to the present.

The following strategy was adopted to handle this material with the most efficiency. While it is not practical to read through every book on the local history of the Faroes, it is possible to scan them visually, checking for an index, then if there is one, looking for an entry on earthquakes, and looking at the contents of the chapters, seeing if the subject of earthquake would fit in with any of them, and scanning the pages. Certain books that look especially promising in terms of containing miscellaneous items of historical detail, especially those set out as chronologies, can be read more thoroughly when discovered. The aim of the researcher is to assess the likelihood that each volume is the sort of work that might contain references to earthquakes being felt, and

then devoting an amount of time proportional to that prospect in actually turning the pages. In this way a large number of books can be worked through effectively in a relatively short time. This procedure works best when all books are available on open stacks, or the researcher is permitted access to closed stacks. In the case of the National Library, about half of the relevant material is on open stacks; the remainder had to be accessed through the catalogue ordering system, which is very much less efficient.

For reasons given above, a very high priority was given to the use of local newspapers. It was decided to make a complete scan of the whole of *Dimmalæting* up to 1955 (after this date it is likely that any earthquakes would still be remembered, as in the case of the 1967 sequence discussed later in this report, or covered in the Geological Department records). This is quite a large undertaking, given that this represents 79 years worth of newspapers. Practical factors making the task easier are: a) the paper was mostly published twice weekly (never daily); b) for the bulk of its existence the paper only ran to four pages per issue; c) of those four pages, only a few columns would be devoted to local news, rather as in a British local newspaper of the 18th century (Musson, 1986). Practical factors making the task harder are: a) the earlier issues are printed in black letter type, which is hard to read and very difficult to scan quickly; b) before World War II the issues are entirely in Danish, and often in a very stilted, quasi-Biblical Danish, for reasons discussed earlier; c) the issues can only be consulted on microfilm; this is not a problem for most researchers who wish to find one issue of the paper and read it, but it is a very unfortunate medium from the point of view of someone wishing to scan long runs of papers very quickly. Problems of focussing, film winding and back-lighting slow one's progress.

### 3.3. *Other sources*

The records held by the National History Museum as the Archives of the Geological Department are for the most part its own administrative records rather than papers of scientific historical interest, but contain also

enquiries from the public and from companies as well as various technical reports. This collection dates back to 1951. It is therefore to be expected that any widely-felt earthquake in the latter part of the 20th century might find some expression here.

By making contacts through the National Archive and the History Department of the University of the Faroes a number of local historians were consulted who have extensive experience of historical documentation of the Faroe Islands. The project also received newspaper coverage in an issue of *Sosialurin*, increasing the likelihood that anyone with any relevant knowledge would be able to make contact with the project (as in fact happened).

Danish sources in Copenhagen would obviously be of interest, but examination of these was beyond the resources of the project.

#### 4. Results

Despite the considerable effort that went into the project over several months of research, almost nothing new was uncovered, and certainly nothing at all in the way of positive identification of historical earthquake events. Although the sum total of known earthquakes remains the same as before the project, what has changed is that previously it could be argued that the lack of known earthquakes reflected a lack of knowledge of the source materials. Now it is clear that the lack of known earthquakes is due, within certain limits that will be discussed later, to the lack of any earthquakes having taken place. The following discussion of what is known of Faroese «seismicity» is adapted from Musson and Ziska (1998). In addition to one genuine earthquake sequence, descriptions are presented of other events that have been brought forward as being conceivably relevant, but which do not actually involve, or cannot be shown to involve, actual earthquakes.

##### 4.1. Early records

As discussed earlier, a principal source of information on earthquake activity is often to be

found in the works of 18th and 19th century antiquarian writers, who often attempt to write complete local studies including both civil and natural history. Such authors often note the mention of earthquakes in old documents, especially if this would be considered an unusual event.

The two most important natural/civil histories for the Faroes are Debes (1676) and Landt (1810). Neither of these studies describe any earthquakes as having occurred in the Faroes. Debes (1676) describes some remarkable sea waves known to affect the islands, which could be read as slightly resembling tsunamis in character. A feature of these waves, which are strong enough to sink a boat hit by one, is that they occur sometimes in calm weather as well as in bad weather. The name given to this phenomenon is «boffves». Landt (1810) uses the word «bovers» to describe what is presumably the same thing. He explains bovers as being waves resulting from swell hitting sunken rocks. This tallies with the account given by Debes (1676) – as boffves apparently tend to occur in fixed places around the islands, and constitute a known hazard to navigation, although he gives one account of a wave suddenly appearing under a boat close to the shore in a location where no previous boffve was known.

The following extract from Debes (1676 – in a contemporary English translation by «J.S.») shows the nature of the phenomenon:

Between these several divided Islands there runneth many strong Currents in several manners ... which causeth specially in Winter when there is a storm, and the wind bloweth against Tide, a terrible and turbulent Sea, principally where there is ground near the surface of the water; for where those grounds stretch themselves towards the Land, the Sea raiseth itself and tumbleth about against it, so that it is terrible to consider, yea it breaketh so strongly against the Land that scarce any Ship where it is sufficiently deep, can get over them, which grounds with breaking waves are called in the Language of *Feroe*, *Boffves*. If there comes any Boats on these *Boffves*, when they break, it is presently sunk, with men and all.

It happened for 16 years ago, that *Mr John Hanson Hardy*, ... came upon such a *Boffve* in pretty good weather, yet both he and ... [*the other people in the*



boat] were all drowned, And the Boat sunk by the Boffve ...

It is very observable, that when the said Boffve breaketh in bad weather, it doth so three or seven times together, without ceasing, and then resteth some time ...

Besides, the *Boffve* breaks also in still weather ...

One point of interest is that Debes (1676) attempts to explain the formation of boffves, and in the course of his hypothesis, he drags in reference to the Aristotelian explanation of the occurrence of earthquakes (as due to air trapped under the earth). Given Debes's discursive style it is very probable that if he knew of any earthquakes having happened in the Faroes he would mention the fact at this point in support of his case.

#### 4.2. *The September 1906 Mykines event*

This was uncovered in the course of searching through the run of *Dimmalæting*. In the issue for 27 October 1906 (p. 2), the headline appears «Jordskælv paa Færøerne» (Earthquake in the Faroes). The item reads:

The first of this month it was reported in *National-tiende* [a Danish newspaper] that according to a private telegram from the Faroes an earthquake had occurred there, and half of Mykines had sunk into the sea. The paper added that the details of the telegram had not been confirmed.

Of course, this communication caused great alarm in Copenhagen. It was well known that in historical times there had been no earthquakes or volcanic activity in the islands; but the islands are, of course, of volcanic origin so it would not be unreasonable if volcanic activity should start again. However, when a telegram was sent to Tórshavn, a calming reply was received, which was published in the papers the next morning.

It seems that the rumour started with a telephone conversation between a Faroese living in Copenhagen with another person who gave a couple of names of people (well known in the Faroes) from whom he had got to know about the earthquake.

The original is shown in fig. 2.

It is assumed that 1 October is the date of the issue of *Nationaltiende*, and thus the notional event would have occurred in September. However, the event is obviously spurious. Apart from the ludicrous detail of half of the island of Mykines (the most westerly of the inhabited islands) falling into the sea, the account can also be dismissed from the lack of any supporting local information.

What is very interesting from the standpoint of this report is the fact that an author writing in 1906 specifically says that no earthquake is ever known to have occurred in the Faroes. Therefore, not only is it the case that at the present day there is no living memory of local earthquakes having occurred, or known documents referring to them (except for the 1967 sequence described below); this was also the case at the beginning of the 20th century as well.

This item was reprinted in 1983 (translated into Faroese from the original Danish) in a collection of local history anecdotes (Ísakson, 1983) under the heading «Earthquake in the Faroes».

#### 4.3. *The 18 August 1916 Vágur event*

Knowledge of this event, such as it is, came not from the direct searching of records but through the indirect means of the objectives of the project becoming known to the wider local history community. A local historian reported that, on Vágur, on 18th of August in 1916, there occurred a rather odd event in Sørvágur. Suddenly the sea ran very high – only for a short moment. The wave reached up to the church which is situated about 200 m from the shoreline. The weather was good this day and dead calm (S. Jacobsen, personal communication, 1999). He believed that similar events have been recorded elsewhere on the islands.

Three hypotheses can be put forward to explain this event:

1) This was a tsunami from a distant event somewhere in the Atlantic. This is not very likely, and no such event is recorded on this or adjacent days anywhere in the Atlantic area.

2) This was a localised tsunami from a submarine slump within Sørvágsfjørður (the fjord

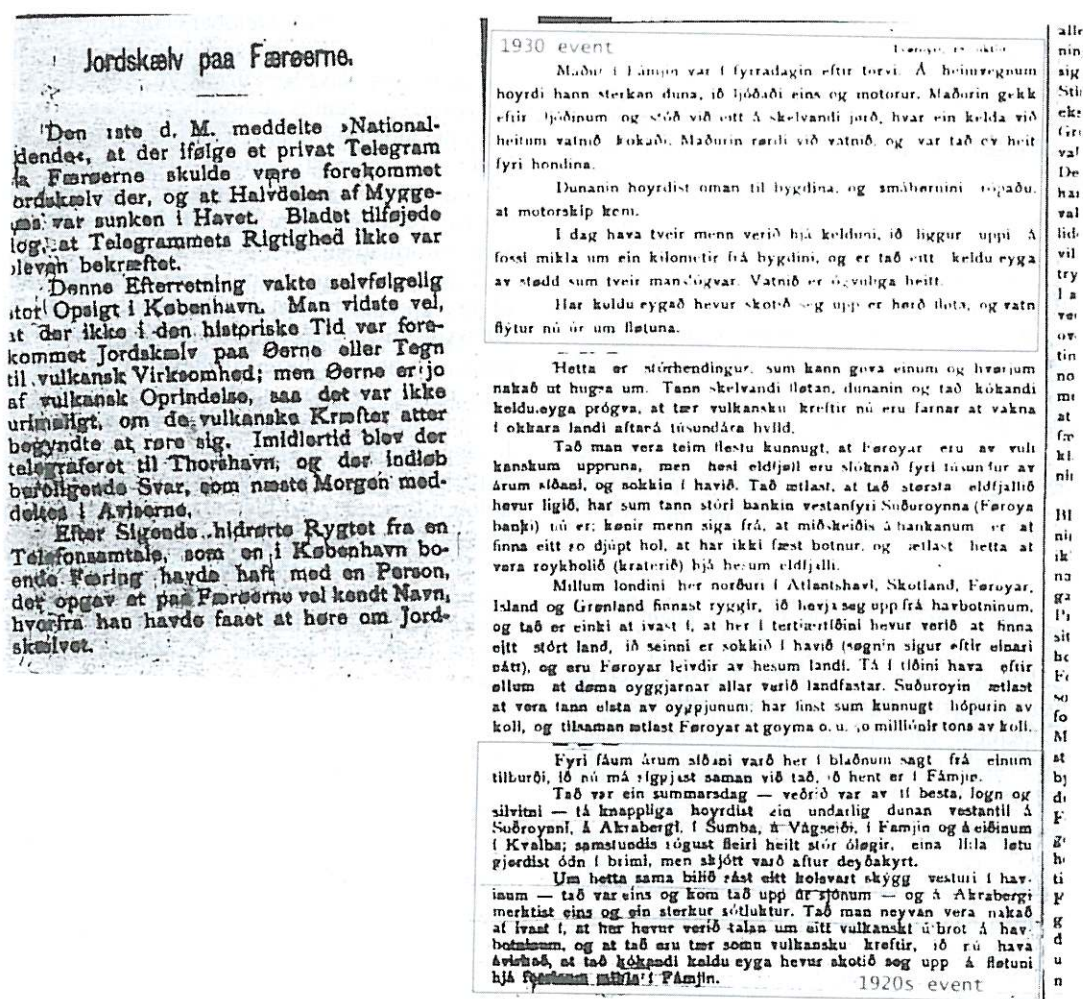


Fig. 2. Two news items from *Dimmalætting*: the one on the left is from the issue of 27 October 1906 (p. 2) and the one on the right is from 22 October 1930 (p. 3). See Sections 4.2 and 4.4.

at the head of which Sørvágur stands). It would be interesting to see if any trace of such a slump exists from survey; the area that would need to be surveyed would not be very large.

3) As with (2), but the source was an above-water landslide falling into the fjord further down. Given that the fjord is not very big, this seems less likely; the landslide would most likely have been noticed.

4) This was another boffve as described in Section 4.1.

On balance, the favoured explanation is the second one. Such events within fjords are well-known in Norway, and match the description of the present case (Aarseth *et al.*, 1989; Blikra *et al.*, 1999). There is no reason to suppose any earthquake was involved.



#### 4.4. Event in the 1920s

A peculiar incident is described by the newspaper *Dimmalætting* [22 Oct 1930 p3], the date being given only as «a few years ago» in the summer. The item is reproduced in fig. 2. The description reads:

... the weather was very good with glassy clear water. Suddenly a weird rumbling sound was heard to the west of Suðuroy, in Akrabyrgi, in Sumba, in Vágseiði, in Fámien and in Hvalba. At the same time this happened several very large waves were observed like a sudden storm. But soon everything was calm again. At the same time a black cloud was seen towards the west. It was as if it had come out of the ocean. In Akrabyrgi a strong sulphur odour was smelt.

The places mentioned are all on the island of Suðuroy, southernmost of the inhabited islands of the Faroes (see fig. 3), and run from the south tip along the west coast to near the northernmost point (technically Hvalba is on the east coast, but the island is very narrow at this point). Whatever this event was, it does not seem to have been an earthquake. There is no mention of any shaking being felt. It reads more like an undersea eruption, or even just a large distant eruption, but this does not seem very likely either. There are no candidate volcanoes; the Faroes are rather far from the mid-Atlantic ridge, and there were no large Icelandic eruptions around this date – and in any case, an Icelandic eruption would be noticed in the Northern Faroes rather than on Suðuroy.

Another possibility is that this was a large underwater landslide, and this is the most probable explanation. Of course, such an event could have been triggered by a small earthquake, but there is no evidence that it necessarily was.

An examination of the bathymetry off the west coast of Suðuroy shows a number of embayments which could be the loci of underwater slumps. However, the resolution in the available map (Føroya Jarðfrøðisavn, 1977) is not very high. It would be possible to make a further investigation by marine survey, but in contrast to the 1916 event, here the event cannot be so closely localised – but is clearly bigger.

#### 4.5. Event on 16 October 1930

The source for this event is the same newspaper issue as for the previous item. The description runs as follows:

18 October - A man out in the fields heard a rumbling sound like an engine. He walked towards the sound and was suddenly standing on trembling earth. On this spot he found a spring that was boiling. He tried to put his hand in the water, but the water was too hot to touch. The rumbling sound was heard down in the village and the children shouted that an engine ship was coming. Today (two days later) two men went to see the spring, which is about 1 km from the village. The spring has a size that is comparable to the palms of two men's hands. The water is very hot. The spring has surfaced in an area of solid rock and the water is now flowing over the surface.

No placename is given. The date given is the dateline for the writing of the article and so it seems the date of the event is 16 October.

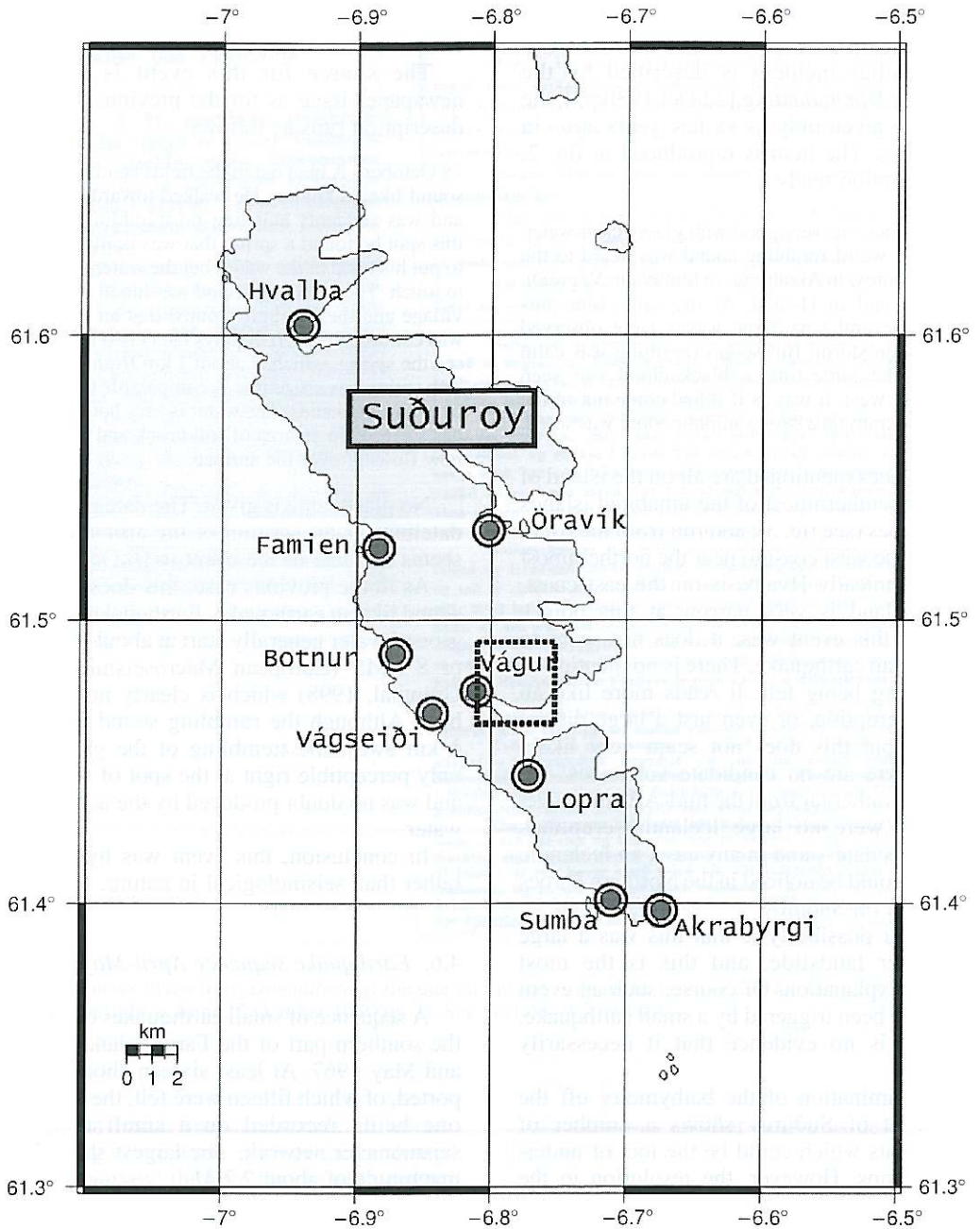
As in the previous case, this does not really sound like an earthquake. Earthquake effects on ground water generally start at about intensity 7 or 8 EMS (European Macroseismic Scale – Grünthal, 1998) which is clearly not the case here. Although the rumbling sound was heard 1 km away, the trembling of the ground was only perceptible right at the spot of the spring, and was no doubt produced by the action of the water.

In conclusion, this event was hydrological rather than seismological in nature.

#### 4.6. Earthquake sequence April-May 1967

A sequence of small earthquakes occurred in the southern part of the Faroe Islands in April and May 1967. At least sixteen shocks are reported, of which fifteen were felt, the remaining one being recorded on a small temporary seismometer network. The largest shock had a magnitude of about 2.2  $M_L$ .

The main source of the data for this sequence is a notebook kept by Joannes Rasmussen, who was the Faroese State Geologist at the time, which records the felt reports, mostly from Faroese police, and the reaction of the scientific communities in Denmark and Iceland.



**Fig. 3.** Map showing the location of places in Suðuroy mentioned by name in connection with the undated event in the 1920s (Section 4.4) and the 1967 sequence (Section 4.6). The dashed rectangle marks the location of the sketch map in fig. 5.



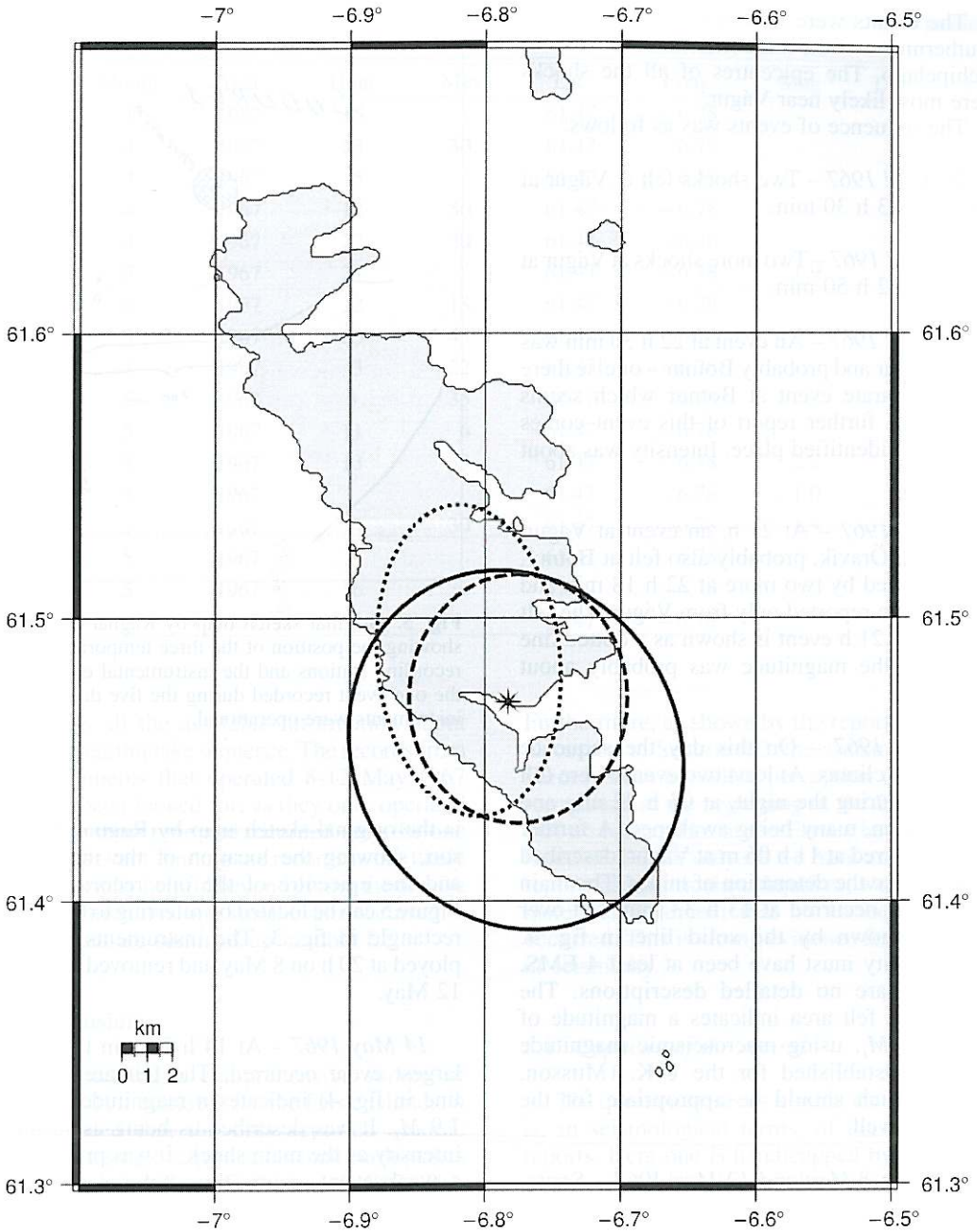


Fig. 4. This map shows the extent of the felt areas of the earthquakes of 1 May 1967 (dotted line), 3 May 1967 (solid line) and 14 May 1967 (dashed line). The star is the approximate macroseismic location of the epicentres.

The events were only felt on Suðuroy, the southernmost of the main islands of the Faroese archipelago. The epicentres of all the shocks were most likely near Vágur.

The sequence of events was as follows:

*26 April 1967* – Two shocks felt at Vágur at 15 h and 23 h 30 min.

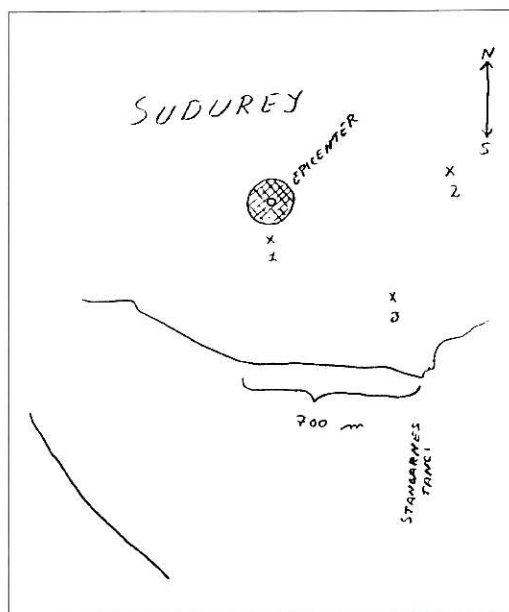
*27 April 1967* – Two more shocks at Vágur at 05 h and 12 h 50 min.

*30 April 1967* – An event at 22 h 30 min was felt at Vágur and probably Botnur – or else there was a separate event at Botnur which seems unlikely. A further report of this event comes from an unidentified place. Intensity was about 3 EMS.

*1 May 1967* – At 21 h, an event at Vágur, Lopra and Öravík, probably also felt at Botnur, was followed by two more at 22 h 18 min and 23 h 45 min reported only from Vágur. The felt area of the 21 h event is shown as a dotted line in fig. 4; the magnitude was probably about  $1.9 M_L$ .

*3 May 1967* – On this day the sequence reached its climax. At least two events were felt at Vágur during the night, at 03 h 22 min and 03 h 35 min, many being awakened. A further event occurred at 11 h 06 m at Vágur, described as being like the detonation of mines. The main shock then occurred at 13 h 33 min, felt over an area shown by the solid line in fig. 4. The intensity must have been at least 4 EMS, but there are no detailed descriptions. The size of the felt area indicates a magnitude of about  $2.2 M_L$ , using macroseismic magnitude relations established for the U.K. (Musson, 1996), which should be appropriate for the Faroes as well.

*Between 8 May and 12 May 1967* – Some time during this period a small shock was recorded on three temporary instruments deployed by two seismologists (Ragnar Stefánsson and Haraldur Sigurðsson) from the Icelandic Meteorological Office. The depth was about 1.2 km and the magnitude less than  $-1.0 M_L$ . Figure 5



**Fig. 5.** Original sketch map by Ragnar Stefánsson showing the position of the three temporary seismic recording stations and the instrumental epicentre of the one event recorded during the five days that the instruments were operational.

is the original sketch map by Ragnar Stefánsson, showing the location of the instruments and the epicentre of the one recorded event. Figure 5 can be located by referring to the dashed rectangle in fig. 3. The instruments were deployed at 20 h on 8 May and removed at 14 h on 12 May.

*14 May 1967* – At 14 h 30 min the second largest event occurred. The felt area (dashed line in fig. 4) indicates a magnitude of about  $1.9 M_L$ . It was described as being as strong in intensity as the main shock. It was preceded by a weak event «some time before». A further event occurred at 16 h 30 min, also described as weak (location not given).

*15 May 1967* – The last reported event occurred some time this morning, described as «heard by some» and weak.



**Table I.** The 1967 earthquake sequence in the Faroe Islands. Times are UTC. Magnitudes are  $M_L$ ,  $I_0$  is epicentral intensity (EMS-98).

Day	Month	Year	Hour	Min	Lat.	Long.	Mag	Dep	$I_0$
26	4	1967	15		61.47	-6.78			
26	4	1967	23	30	61.47	-6.78			
27	4	1967	5		61.47	-6.78			
27	4	1967	12	50	61.47	-6.78			
30	4	1967	22	30	61.47	-6.78			3
1	5	1967	21		61.47	-6.78	1.9		
1	5	1967	22	18	61.47	-6.78			
1	5	1967	23	45	61.47	-6.78			
3	5	1967	3	22	61.47	-6.78			
3	5	1967	3	35	61.47	-6.78			
3	5	1967	11	6	61.47	-6.78			
3	5	1967	13	33	61.47	-6.78	2.2		4
	5	1967			61.47	-6.78	-1.0	1	
14	5	1967	14	30	61.47	-6.78	1.9		
14	5	1967			61.47	-6.78			
14	5	1967	16	30	61.47	-6.78			
15	5	1967			61.47	-6.78			

This is all the available information about this small earthquake sequence. The records from the instruments that operated 8-12 May 1967 have not been looked for; as they only operated for a very short time and recorded only the one very small event, finding the records is not likely to be especially helpful beyond giving the precise date on which this one small event occurred.

The data are summed up in table I.

## 5. Conclusions

After making a comprehensive survey of historical data available for the Faroe Islands, it is concluded that the only reported seismic activity is a single sequence of small earthquakes that was observed on Suðuroy in 1967. This sequence was known about before the project started, and no further genuine earthquakes were discovered. The difference the project has made is that one can now be certain that the lack of more reported earthquakes in the islands is not due to no-one ever having searched for them.

Furthermore, as shown by the report from 1906 discussed in Section 4.2, the aseismicity of the Faroes is not a modern perception only; it was recognised at the beginning of the 20th century that no earthquake in the Faroes had ever been heard of. So not only do we have an absence of reports of historical earthquakes; we also have a historical statement that no earthquakes ever occurred. This is strong evidence for a real lack of seismicity.

### 5.1. Capacity of the record

The question arises as to what the significance is, in seismological terms, of the absence of reports. Here one is handicapped by the nature of the island location of the Faroes. It is not possible to make assertions about magnitude completeness, since a magnitude 3.5  $M_L$  earthquake in Southern Vestmanna would probably make more of an impact on the historical record than would a magnitude 5.0  $M_L$  event 100 km west of Mykines. The determining factor is the

maximum intensity produced in inhabited areas, and thus a remote large earthquake will not carry the same weight as a smaller, closer one. The distinction between assessing earthquakes in terms of magnitude and intensity is important here. Magnitude is not necessarily an indicator of impact on the human environment (depth and distance may attenuate the effects), but intensity is, and so can be more easily related to the historical record.

The following estimation is made on the basis of what source materials are available and what sort of things are recorded.

Before 1550 one can make no statement about what earthquakes might have occurred.

After about 1550, and certainly after 1600, it seems very unlikely that any earthquake could have occurred that might have done major damage or caused fatalities. One could rule out an earthquake of intensity 8 EMS or greater with some confidence. It may be noted in passing that traditional Faroese houses would probably have been fairly good at withstanding earthquakes, considering the necessity of resisting winds. However, strong earthquake shaking would quite likely have an effect on the many steep slopes of the islands (and many *bygdir* are situated in locations vulnerable to landslides).

Between 1600 and 1800 it becomes progressively less likely that an earthquake of intensity 7 or even 6 EMS could ever have occurred without it being known to us.

After about 1850, and certainly after 1880, it seems unlikely that an earthquake of intensity 5 EMS could have escaped mention. Probably not even 4 EMS could have occurred.

After about 1920, and certainly after 1950, it is highly improbable that an earthquake of intensity 4 EMS could have occurred without it being known to us.

In all these estimates, it is assumed that the peak intensity refers to a significant inhabited area, maybe two or three villages at the very least, and not a single isolated farm (like the one on Stóra Dímun). Such estimates are always uncertain, since one cannot test them against real data. One would have to know of a historical earthquake that occurred but was not reported (in which case one would not know of it).

However, these represent our best attempt at expressing the capability of the historical record of the Faroe Islands to preserve information on earthquakes.

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