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Abstract

The 1607 coastal flood was a high magnitude event that may have been the result of either a storm surge or a tsunami wave(s). Contemporary accounts describe the impacts of the surge/wave at Appledore and Barnstaple in North Devon, and a 19th century comment exists for Hayle in Cornwall. An examination restricted to these local accounts reveals that the surge altitude or tsunami run-up at Appledore, at the estuary mouth, exceeded 8.5 in OD (a surge/wave height in excess of 3.28 in, possibly lip to c. 7-8 in), and at Barnstaple, about 12 km up-estuary it reached 7.53 in OD (a surge/wave height of 1.83 in). Damage included houses 'overthrown and sunk' at Appledore and a number destroyed at Barnstaple where there are three named fatalities. Also, a 60 ton ship was transported inland by the wave at Appledore. Most of the contemporary accounts mention strong winds, supporting a storm origin for the flood; however, an unpublished model requires hurricane winds of 128.7 kmh (80 mph) to reconstruct the observed flooding. Such winds alone would result in widespread damage and casualties, inland as well as at the coast, but there is no mention of either in any historical document that we have seen, indeed, contradictory accounts from the Severn Estuary state the day was 'most fayrely and brightly spread'. The ambiguity of the regional meteorological conditions, the lack of documentary evidence for hurricane winds, and the nature of the damage inflicted do not allow us to reject the tsunami hypothesis for the origin of the 1607 flood.

Keywords

tsunami, Bristol Channel, Severn Estuary, UK, historical accounts, 1607 flood event

Disciplines

Life Sciences | Physical Sciences and Mathematics | Social and Behavioral Sciences

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THE AD 1607 COASTAL FLOOD IN THE BRISTOL CHANNEL AND SEVERN ESTUARY: HISTORICAL RECORDS FROM DEVON AND CORNWALL (UK)

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The 1607 coastal flood was a high magnitude event that may have been the result of either a storm surge or a tsunami wave(s). Contemporary accounts describe the impacts of the surge/wave at Appledore and Barnstaple in North Devon, and a 19th century comment exists for Hayle in Cornwall. An examination restricted to these local accounts reveals that the surge altitude or tsunami run-up at Appledore, at the estuary mouth, exceeded 8.5 m OD (a surge/wave height in excess of 3.28 m, possibly up to c.7-8 m), and at Barnstaple, about 12 km up-estuary it reached 7.53 m OD (a surge/wave height of 1.83 m). Damage included houses 'overthrown and sunk' at Appledore and a number destroyed at Barnstaple where there are three named fatalities. Also, a 60 ton ship was transported inland by the wave at Appledore. Most of the contemporary accounts mention strong winds, supporting a storm origin for the flood; however, an unpublished model requires hurricane winds of 128.7 kmh (80 mph) to reconstruct the observed flooding. Such winds alone would result in widespread damage and casualties, inland as well as at the coast, but there is no mention of either in any historical document that we have seen, indeed, contradictory accounts from the Severn Estuary state the day was 'most fayrely and brightly spread'. The ambiguity of the regional meteorological conditions, the lack of documentary evidence for hurricane winds, and the nature of the damage inflicted do not allow us to reject the tsunami hypothesis for the origin of the 1607 flood.

INTRODUCTION

Bryant and Haslett (2002) review the main historical accounts that describe the high magnitude coastal flood event of 20th January 1607 that affected the Bristol Channel and Severn Estuary region in southwest Britain. The historical accounts examined in that paper were from relatively well-known contemporary pamphlets - with their woodcuts - and Camden (1607), which describe the flood impacts mainly in Somerset and Monmouthshire, with only passing mention to other localities that were affected, such as Gloucester, Devon, Carmarthen and Cardigan.

Bryant and Haslett (2002) questioned the commonly held view that the flood was caused by a storm, suggesting that it may have been due to a tsunami. This alternative theory is partly based upon the contemporary descriptions of the event, that it occurred on a day that was 'most fayrely and brightly spread', that a singular wave inundated the coastal lowlands 'with a swiftness so incredible, as that no gray-hounde could have escaped by running before them', that the wave appeared as 'mighty hilles of tumbling water over one another in such sort as if the greatest mountains in the world had overwhelmed the lowe villages or marshy grounds', and that 'it dazzled many of the spectators that they imagined it had bin some fogge or mist coming with great swiftness towards them and with such smoke as if mountains were all on fire, and to the view of some it seemed as if myriads of arrows had been shot forth all at one time' (Bryant and Haslett

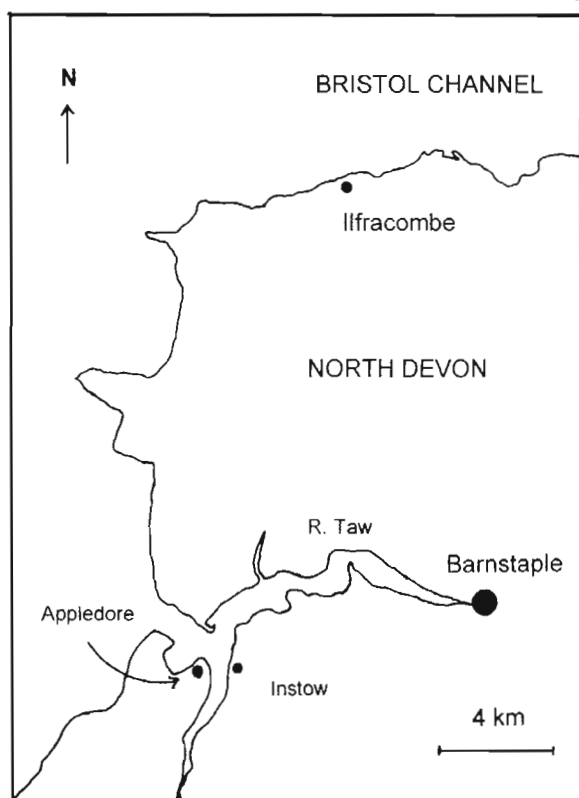


Figure 1: North Devon coastal area indicating the location of places mentioned in the text.

2002, p.164). Such descriptions are very similar to other eyewitness accounts of tsunami. In this paper, we will use 'wave' in a similar way to the pamphlets, to refer to the initial inundation, although in using this we do not intend to necessarily imply it is a tsunami or a storm surge.

Bryant and Haslett (2002) also speculated that physical evidence may exist in the Severn Estuary to corroborate this view in the form of previously published anomalous findings that possess a chronological link to the flood event, such as the extensive erosion of salt marsh, the truncation of spurs of land, and the deposition of sand layers, phenomena that are often considered to be signatures of tsunami (Bryant 2001). Fieldwork by the authors in 2004 has identified a number of new sites that possess features that warrant further investigation.

In order to advance the debate it is important to examine all contemporary sources and here we examine previously neglected

documentary sources from Devon (Figure 1) and Cornwall only. These historical documentary records are limited in comparison with the published pamphlets of the time, but offer new detail that contributes to our understanding of the flood event at these localities, although we have not yet taken the psychological state of the contemporary witnesses and authors into consideration. Some of these records are in the form of notes and memoranda from parish registers and town chronicles, and will be briefly considered alongside the entries in the main pamphlets for this area.

Fieldwork was undertaken in September 2004 at most of the locations mentioned in these sources. To explore potential new avenues of research, fieldwork included making preliminary observations on building dates along the seafront at a number of locations, primarily making use of date stones, but also using publications. It is fully appreciated that without detailed building surveys it is impossible to be certain of the construction date of a standing structure; indeed, it is common for a date stone to refer to renovation rather than original construction. Although these data should be treated with caution for buildings at Appledore and Instow, the age of buildings in Barnstaple, suggested by date stones, are confirmed by the *Barnstaple Historic Buildings Survey 1985-1986*.

APPLEDORE AND INSTOW, DEVON

One published pamphlet, entitled *More Strange News*, refers to events in Appledore at the mouth of the Taw Estuary where "many houses are overthrown and sunk" by the wave. This passage suggests that the cliff-top houses were not simply flooded but completely destroyed by a wave that possibly overtopped (ie 'overthrown') them causing them to collapse (ie 'sunk'). The altitude of the sea front at Appledore is indicated by spot heights of 7.9 and 8.5 m OD, therefore, suggesting the surge height or tsunami run-up must have exceeded 8.5 m above OD to warrant the descriptions afforded by the chroniclers. The predicted height and time of the high tide on the morning in question at Appledore is 5.22 m OD at 7.25 am, implying that a surge/wave height in excess of 3.28 m is required to begin to inflict the damage recorded (Table 1); indeed, if houses were overtopped then the surge/wave height would

Levelled features	Chart Datum (m) Appledore	Ordnance Datum (m) Newlyn	Local water depth (m)
Altitude of sea front at Appledore	11.68	8.5	
Predicted high tide at 7.25am on Tues 30th [20th] January 1607	8.4	5.22	
Minimum surge/wave height (tidal excess)	(11.68)	(8.5)	3.28 (possibly up to 7-8m)
Chart Datum (Appledore)	0	-3.18	
Ordnance Datum (Newlyn)	3.18	0	

Table 1: 1607 tide and flood levels in Appledore (see text for discussion).

have to be in the region of at least *c.* 7-8 m high, a run-up of *c.* 12.22-13.22 m OD.

Date stones on buildings at Appledore suggest the oldest surviving building on the sea front is Port Cottage built around 1750. It therefore appears possible that the events of the 1607 disaster may have lasted for a considerable time in the folk memory of the local community. Other buildings on the sea front and along Irsha Street suggest a date from the 18th century, including the Royal George public house.

The pamphlet continues with a description that indicates the power of the wave, in that "a ship of some three score tonne, being ready to hoist sail, and being well laden, was driven by the breach of this tempest up into a Marrish ground beyond all water-mark, and is likely never to be brought back again." The transport of such a large vessel by the wave is reminiscent of similar occurrences associated with known tsunami, such as the two warships that were carried inland by the Peruvian tsunami of 1868 (Bryant 2001). It also begs the question, would a ship of this size be well laden and ready to sail in the hurricane storm conditions necessary to approximate the effect of

a tsunami? It is clear from this passage that use of the word 'tempest' refers to the wave as well as, or instead of, stormy weather conditions.

Appledore occurs mainly along a drift-aligned section of the estuary shore (although the western end is swash-aligned), so that the wave front would probably have struck perpendicular to the shore and peeled along it, notwithstanding possible effects of refraction. Instow however, lies to the east (up-estuary) of Appledore at the confluence of the Taw and Torridge estuaries, and is swash-aligned, so that the wave would have struck head on. Although none of the historical accounts specifically mention Instow, it must have suffered considerable damage, as even today floodgates protect the sea-front road behind the seawall. A spot height of 5.2 m OD occurs at the sea end of Old Quay Lane, indicating the sea front here is considerably lower than at Appledore as Instow, unlike Appledore, is not perched on low cliffs. Indeed, the sea front altitude at Instow is equal to the predicted tidal height that morning in 1607.

The oldest surviving building along the seafront at Instow appears to be the Sailors Rest

Cottage with a modern date stone suggesting construction in 1640, 33 years after the 1607 disaster. It is possible that the scale of destruction experienced at Appledore was repeated at Instow, if not worse, and that reconstruction might have been understandably slow to follow.

BARNSTAPLE, DEVON

Barnstaple lies near the head of the Taw Estuary, mainly on its northern bank, some 12 km from the open sea. Information from the Barnstaple parish register (reference NDRO. 3054A/PR1) includes a short memorandum recorded by Robert Langdon, the parish clerk. It reads: '1606. In the 20th daye of Janiarii 1606 there was suche a mightie storme and tempeste from the River of Barnstaple with the comminge of the tyde, that yt caused much lose of goods, and howses, to the vallew of tow thousand pownds, besyds the death of one James Ffrost, a toaker [ie tucker] and tow of his children in which his howse fell downe upon them & killed them. This storm begane at 3 of Clock in the morninge, and continewd tyll 12 of Clock of the same daye, per me Robert Langdon, Clarke, teste'. The *Lost Chronicle of Barnstaple* states that the Barnstaple parish register also records the death of James, Sabine and Catherine Frost on 20 January 'with the fall of their house' (Gray 1998), although we have not seen the original of this particular record ourselves.

There is also another memorandum of the event in the town chronicle of Barnstaple, written by the town clerk, Adam Wyot that comes from a copy of the chronicle housed in the Somerset Record Office (ref. SF 4051), which reads: '1606. On Tuesday morning being the 20th day of January and upon the highest of the spring the winde blowing very hard at South-west, ther was such a flood or tide as the like was never seen in this towne. It come into all the houses and sellers neer the key with such a powre, that it burst open dores that were lockt and bolted, and threw downe many houses and walls, that this towne hath received losse in salt, sugar, oade, etc. to the valew of one thousand pounds. In southgate street it came up above the plumpe, also more than halfe way up Maiden street, in Crockstreet it came up so far as Mr Takels hall-doore; the tombstone upon the key was covered clean over with water by report of diverse: It threw downe the whole

house wherein one James Frost did dwell wherby himselfe was slayne with fall of the rooffe, and his two children lying in their bed, were slayne with the fall of the wall upon them. This tide went clean over the Pilton bridge, and so shooke the wester wall thereof, that it was moved three or fower inches out from the cawsey and much of it ready to fall down, etc. The water was higher at this tide by 5 or 6 foot than ever it was seen by any now living'.

The North Devon Records Office holds a different version (ref. NDRO.B12/1), which reads: 'A very great flood - damage £1000 - water came up in Southgate Street above the plump to the higher end of Thomas Harris house, and in Wilstreet upp that way untill the Widow Taylors window, it come to Appleys fore door & run out thro the house into the Garden there & made great spoyle. The water flowd up more than half way Maiden Street & then went into there houses. Also it came upp at the lower end of Crockstreete so far Mr Takles hall door. The Tombstone upon the Kaye was coverd clene over with water - by report it was higher by v or vi foote than ever remembred by those now livinge. First to digresse westward from the Kaye it threw down a great part of the utter wall of Mr Collybears house - it cast down the easter wall of Mr Dodderidges Courtledge upon the Kaye. It had almost cast down a little House of Mr Stanberie's standynge there in the east part of the Kay, but it brused it soe that they were dryven to draw it down for fear of falling & make it upp agayne. It threw down the whole house whereon James Frost did dwell whereby himself was slayn with the fall of the rooffe & two Children lying within bed were slayn with the falling of the Walls. All the walls between that and the Castle fell and the top of the house of the horse Mill began to cleave asunder & likely to have fallen down if the Spill of the Mill wch was very strong had not supported. It cast down divers walls in Litchdon - it hurted all the walls on the Kay next the River'.

Tristram Risdon (1620) also recounts some years later the 1607 flood in Barnstaple stating that 'in the year 1607, it [Barnstaple] suffered a kind of inundation, amongst divers others on the Severn side, at a spring tide, driven by a very strong perry, from the ocean so high swelling, that it subverted houses, drowned beasts, and

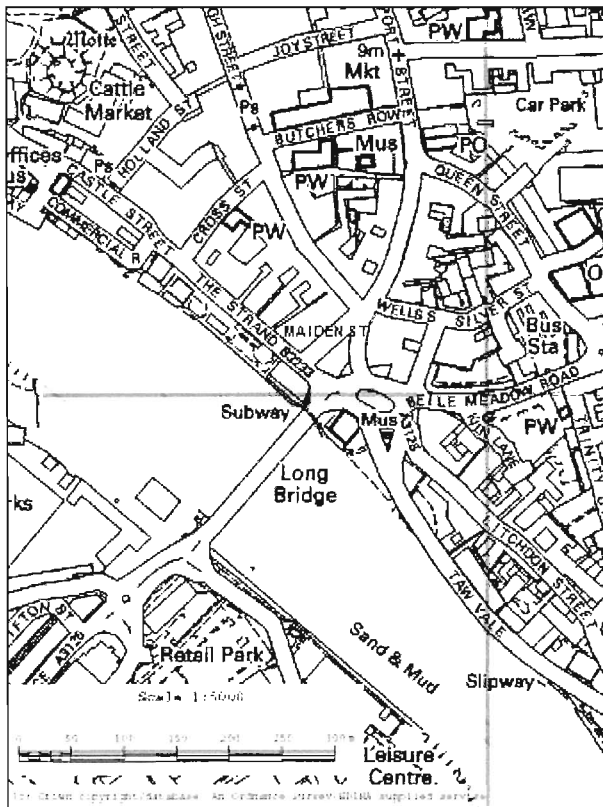


Figure 2: Street plan of present day Barnstaple, Devon (© Crown Copyright Ordnance Survey, an Edina Digimap/JISC supplied service used with permission).

destroyed people, of whom some, to save their lives, were constrained from their upper rooms to take boat and be gone. This river [the Taw], at some changes, and full of the moon, so overfloweth the marshes, that the town seems to be a demi-island’.

Of these accounts, the first by Robert Langdon makes much of the stormy conditions, but intriguingly states that the ‘mightie storme and tempeste [came] from the River of Barnstaple with the comminge of the tyde’. In a similar way to the use of the word ‘tempeste’ at Appledore (see above) it seems here also to be referring to the wave. However, if the storm ‘begane at 3 of Clock in the morninge, and continewd tyll 12 of Clock of the same daye’ it is likely that strong winds are being referenced, although as is the case in all the pamphlets there is no mention of rain, or indeed damage done by these winds either in the flood affected areas or elsewhere inland. It is clear that the use of the word ‘storm’ in these

documents does refer to strong wind, but that ‘tempest’ probably refers to the catastrophic wave (cf. ‘the ocean so high swelling’ of Risdon (1620)) that caused the devastation. Adam Wyot’s account from the Somerset Record Office corroborates Langdon’s report, as does Risdon (1620), and less ambiguously states that ‘upon the highest of the spring the winde [was] blowing very hard at South-west’, although it is curious that his account suggests that the wind coincides with the flood and no sense of Langdon’s nine hour storm is conveyed. The other version of Wyot’s account from the North Devon Records Office makes no reference to storms or wind, only the ‘very great flood’. Also, Risdon (1620) does make a connection with the high spring tide that occurred that morning.

The physical impact of the wave, and that much structural damage was experienced, is clearly conveyed in Wyot’s accounts, as the wave ‘burst open dores that were lockt and bolted, and threw downe many houses and walls’, including the house of James Frost, the walls Mr Collybears house, Mr Dodderidges Courtledge, and many in Litchdon, which occurs east along the Taw from the main centre of Barnstaple. Also, ‘the walls between that and the Castle fell and the top of the house of the horse Mill began to cleave asunder’. In accounts of recent storm surge impacts in the region, such as the 1981 surge that affected parts of the Somerset Levels, very little physical damage was experienced due to the power of the floodwaters, inundating the land only at a fast walking pace. The contemporary descriptions of damage together with Risdon’s observation of ‘the ocean so high swelling, that it subverted houses’ are very similar to images of the recent 2004 Boxing Day tsunami impacting the coastline and adjacent communities of Sri Lanka and Thailand.

Some indicators of the extent of the flooding within the town of Barnstaple (Figure 2) are given, such as ‘the water flowd up more than half way Mayden Street’. The distance from the present quayside to the mid-point along Maiden Street is c. 68 m, although on a town plan of 1584 (Lamplugh 2002) the quay appears to extend further into the estuary than its present position, approximately twice the present distance. The altitude of the The Strand that runs along the north bank of the Taw is 5.3 m OD as indicated by a

Levelled features	Chart Datum (m) Barnstaple	Ordnance Datum (m) Newlyn	Local water depth (m)
'the water was higher at this tide [5.1m CD] by 5 or 6 foot than ever it was seen by any now living' (Wyot)	6.62-6.93	7.22-7.53	
General flood level for Barnstaple	5.55 ±0.25	6.15 ±0.25	
Tomb stone on the quay	5.8	6.4	
Pilton Bridge	5.7	6.3	6.2
Lower end of Cross Street	5.5	6.1	
Mid-point of Maiden Street	5.3	5.9	
Predicted high tide at 7.40am on Tues 30th [20th] January 1607	5.1	5.7	
Maximum surge/wave height (tidal excess)	(6.93)	(7.53)	1.38

Table 2: 1607 tide and flood levels in Barnstaple (see text for discussion).

spot height near the junction with Maiden Street, which slopes up to a second spot height of 7.1 m OD in Boutport Street. Simple interpolation between these points gives an altitude of 5.9 m OD for the mid-point of Maiden Street. The waters also 'came upp at the lower end of Crockstreete', which rises from 6.1 m OD near its junction with The Strand ('the lower end') to 7.57 m OD near its far end; therefore, for most of its length Cross Street is altitudinally higher than Maiden Street.

In Cross Street (cf. Crockstreet or Crockstreete of the accounts) the oldest surviving building is No. 8 that was built in 1635, some 28 years after the flood (Mills and Brain 1999). In Litchdon, apparently the oldest surviving building is the Penrose Almhouses built in 1627, and there are also 17th century potteries in Litchdon Street, which were operational until 1990 (Mills and Brain 1999). Therefore, as in Appledore and Instow, all surviving buildings in the areas/streets

named in the historical accounts have been replaced post-1607 and it is likely that damage inflicted by the 1607 event was at least in part a catalyst for reconstruction, either through destruction or weakening of building structures.

Adam Wyot also states that 'this tide went clean over the Pilton bridge, and so shooke the wester wall thereof, that it was moved three or fower inches out from the cawsey and much of it ready to fall down'. Pilton Bridge is situated on the tidal stretch of the River Yeo, a northern tributary to the Taw, approximately 1 km upstream from the rivers confluence at Barnstaple. The road surface of the present Pilton Bridge stands 5.2 m above the bed of River Yeo at approximately 5.3 m OD, with a 1 m high sidewall in addition. Therefore, if the present stone bridge were of similar proportions to its 1607 equivalent, then there would have been a floodwater depth in excess of 6.2 m here.

Other potential indicators of water depth are provided by Risdon's (1620) survivors who were 'constrained from their upper rooms to take boat and be gone', suggesting ground floors were submerged, and Wyot's statement that 'the tombstone upon the key was covered clean over with water'. The tombstone or tome stone was the local name for a heavy stone plinth and table on which merchants used to transact business. However, the tombstone was moved in 1649 from its original position on the quayside, where it stood approximately waist height (c. 1.1 m high) on the river bank. Given that the ground altitude of The Strand is 5.3 m OD, it would appear that the water depth here on the bank rose to at least 6.4 m OD (5.8 m CD). Unfortunately, the tombstone has recently been damaged by vandals and is presently curated in the Barnstaple Heritage Centre.

If all the above are considered as indicators of floodwater depth, eg 5.9 m OD in Maiden Street, 6.1 m OD in Cross Street, 6.3 m OD at Pilton Bridge, and 6.4 m OD over the tombstone on the quay, we see that despite the lapse of time and undoubted changes to roads, bridges, and the quay, they are all within a range 0.5 m, producing a reconstructed floodwater level of 6.15 ± 0.25 m OD for the town of Barnstaple (Table 2). However, Wyot notes that 'the water was higher at this tide by 5 or 6 foot than ever it was seen by any now living'. The predicted high tide for Barnstaple on the morning of the 30th January 1607 (Julian date equivalent of 20th January 1606; the year not changing until March) is a height of 5.1 m CD (Chart Datum) at 7.40 am. Chart Datum is 0.60 m higher than OD at Barnstaple, as the usual residual river flow of the Taw is higher than OD (Adams, 2004). Therefore, assuming the townspeople of Barnstaple had seen near-highest astronomical tides previously in their lives, the 'tide' inundated at a height up to 6.93 m CD according to Wyot's reckoning, which is equivalent to 7.53 m OD. This is 1.38 ± 0.25 m higher than our reconstructed flood level of 6.15 ± 0.25 m OD. It may be considered that the difference of up to 1.38 ± 0.25 m might indicate the height of the initial inundating wave on top of the predicted tide (ie 1.83 m), which if it was not a tsunami allows for a minimum additional 0.2 m for any rise in the tidal levels due to possible barometric effects following the dissipation of a

1.38 ± 0.25 m high wind-driven tidal surge. Alternatively, it could indicate the depth of floodwater at the reported locations; however, if that were the case then flooding would have been more extensive. If it were a tsunami, the additional water level above the predicted high tide could be due to wave translation, and the onshore/up-estuary advection and transport of water. Alternatively, for both scenarios, it may be the effect of any seawalls retaining the floodwater, at least partially preventing either tsunami backwash or for the tidal surge to recede back into the Taw.

HAYLE, CORNWALL

For completeness only, we include here a handwritten note discovered on the front cover page of the 1813-1846 baptism register of St Uny's Church in Cornwall (CROP120/1/3), on the north Cornish coast, which states 'in 1607 in the Reign of James, the First, a dreadful hurricane happened. Perhaps a great influx of sand might have happened at Hayle'. Given that this note was written over 200 years after the event it might be that the author had been aware of the 1607 flood and its documented cause from published sources, and then speculates in very tentative language that the sand accumulations of the Hayle Estuary on the north coast of Cornwall might have been deposited during the event. Alternatively, the author may have been recording a fading local folk memory, or transcribing from a now lost written document. If we generously indulge the latter explanations, then the passage corroborates the occurrence of strong winds, and suggests the associated emplacement of sand deposits. However, we are strongly suspicious of this note.

CONCLUDING DISCUSSION

The impacts of the 1607 wave are dramatically conveyed, firstly in the accounts from Appledore, exposed to the Atlantic, where houses standing at 8.5 m OD were 'overthrown and sunk', and a 60 ton ship was transported inland. Secondly, at Barnstaple, houses in streets adjacent to the quayside were also flooded and destroyed, as were many walls. Records of specific fatalities are limited to three members of the Frost family in Barnstaple, but Risdon (1620) gives the impression that there were more, as well as

animals. A field survey and published building surveys of the areas affected by the wave suggest that no contemporary buildings remain, with oldest surviving buildings in those areas dating to 1627 and 1635 in Barnstaple, *c.* 1640 in Instow, and *c.* 1750 in Appledore. The 1607 event therefore, may have played a significant and lasting role in the historical development of these North Devon coastal settlements.

The wave must have attained a run-up altitude in excess of 8.5 m OD at Appledore to begin to inflict the damage recorded there, a surge/wave height in excess of 3.28 m. However, in the more sheltered up-estuary position of Barnstaple we reconstruct from accounts that the initial inundating wave reached a maximum run-up of 7.53 m OD, equivalent to a wave height of 1.83 m. However, residual floodwater levels appear to have stabilised at 6.15 ± 0.25 m OD in Barnstaple. This is in addition to the predicted high tide level of the morning in question of 5.1 m CD (5.7 m OD) for that port. It is clear that the funnel shape of the Taw estuary did not amplify the wave as it would have in the Bristol Channel. Rather the wave decreased in amplitude by at least 1.45 m between Appledore at the estuary mouth and Barnstaple 12 km upstream due to attenuation and the frictional influence of the estuary sides, which are equidistant for most of the estuary's length, until the final 1-2 km before Barnstaple (note that unlike the Severn, the Taw is a hyposynchronous estuary (Haslett 2000) where tidal range decreases up-estuary). Nor did a tidal bore cause the flooding because a bore is associated with hypersynchronous estuaries and precede high tide, usually by more than an hour. For example, in the River Parrett, Somerset, a tidal bore propagating upriver on a spring tide precedes high tide at Bridgwater by 1 hour and 37 minutes. A similar situation occurs in the River Severn.

The flood of 1607 at Barnstaple appears to have occurred close to the time of high tide at 7.40 am, as it is recorded that Sabine and Catherine Frost were still in their beds when they were killed. However, sunrise was at 7.58 am that morning, so it is possible that the timing of the inundation occurred sometime after high tide. Indeed, it is likely as some of the detail in the eye witness accounts would have been difficult to

observe before sunrise. Given the macrotidal nature of the coast, high tidal conditions are a prerequisite for either a tsunami or storm surge related flood of this magnitude. The reference to strong winds in the majority of the historical accounts from North Devon, despite contradicting accounts from elsewhere, suggests a storm origin for the flood.

Dr Kevin Horsburgh (unpublished data) of the Bidston Observatory has back-modelled the wind velocity required to cause the scale of regional flooding associated with the 1607 event, and suggests that 128.7 kmh (80 mph) winds are needed to create a surge height of 1.5-2 m in addition to the high spring tide. On the Beaufort Scale, this equates to a force 12 hurricane that would have generated mean wave heights of 14 m in the open ocean. Indeed, such high-velocity winds would have resulted in very widespread damage and casualties, not only at the coast, but also inland over much of southwest Britain. In the historical accounts we have examined, there are no records of any damage caused by the wind, only due to the power of the wave. The strongest wind that can cause little or no structural damage is a force 8 gale (39-45 mph or 62.7-72.4 kmh) and it is possible that such conditions were experienced on the day. Therefore, despite the apparent significance of meteorological conditions noted by the contemporary writers, the hypothesis that the flood could have been caused by a tsunami is not rejected. Furthermore, much of the damage caused, particularly at Appledore, is similar to that associated with known tsunami, such as the inland transport of large ships. Moreover, the contemporary writers would seek to explain the flooding from within their sphere of experience, which in these circumstances would extend only to effects of the weather. It is clear that strong winds accompanied the flooding but there is no suggestion of a storm with rain falling, and the inhabitants do not seem to be alarmed before the flood. Interestingly writers appear to use the word 'tempest' separately from 'storm' to refer independently to the violent wave.

It is clear that the 1607 flood was a high magnitude event caused by either a hurricane or tsunami. Despite its association with a high spring tide, necessary for catastrophic inundation, and the undeniably strong winds described in the

North Devon records, we currently favour a tsunami as an explanation of the flood because the recorded damage was restricted to the coast and the wave reached land elsewhere in the Bristol Channel apparently under fair weather.

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