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The Bisat Project
Phase I
Sequential Photographs of the Cliffs of the Holderness Coast

By Graham Kings 2020

INTRODUCTION

The Bisat Project, of the Hull Geological Society, seeks to emulate the work of W. S. Bisat, who between 1935 and 1952 studied and drew the glacial till cliffs of the Holderness coast between Easington and Sewerby. The locations of his drawings were identified by the number of his paces from Easington and photographs of the cliff faces were not taken. The original drawings are held by the British Geological Survey in Keyworth and a version was published in *The Quaternary of Britain* (Catt and Madgett 1981).

In the present study, sequential, overlapping, photographs of the Holderness Coast cliff faces from Sewerby (TA 19891 68464) to Spurn (TA 42010 14971) have been taken and their locations accurately recorded using GPS readings. It was intended that the photographs would be combined to produce panoramic views of the cliff faces. Although it has been eighty years since Bisat’s study it is considered that, at an average erosion rate of 2 metres a year, the difference in the stratigraphy and geomorphology of the coastal cliffs will not be significant. The original Bisat Project team consisted of the author, Rodger Connell, Dennis Haughey, Arthur Speed, Brian Kneller, Derek Gobbett and Paul Thornton.

CAMERA PREPARATION

A Canon single lens reflex digital camera, model EOS 40D, was fitted with a wide angle lens of 17-70mm. The 70mm focal length was used. This setting,

when the camera was placed approximately 30 paces back from the cliff, provided a view of some 35 metres of the base of the cliff thus reducing the number of photographs to be taken. A resolution of objects of 3 cm size, at the cliff face, was obtained by this method although the purpose of this study was, primarily, to record the stratigraphy of the cliffs.
Autofocus was mostly used however, in dull conditions manual focus was used because the autofocus tended to focus on beach objects. Automatic exposure settings were predominantly utilised, except if lighting was poor, when manual exposure was substituted. The camera was attached to a tripod to minimise camera shake in the winds and a spirit level was attached to the camera to ensure that the cliffs were photographed horizontally. A lens hood was fitted to the camera because the cliffs are orientated approximately N-S and there was a risk of direct sunlight entering the lens after midday. This was particularly important near Easington where the cliffs curve to SE.

PROTOCOL IN THE FIELD

Photographs were first taken at Sewerby and then continued in a southerly direction. It was found that, because of the alignment of the cliffs, photography needed to be completed by midday. The best lighting conditions were diffuse bright light to reduce the contrasts of light and shade. The camera was positioned sufficiently far from the cliff to ensure that the top and bottom of the cliff were seen in the viewfinder. In practice this was approximately 30 paces from the cliff line. Using the spirit level, the cliff image was adjusted to be horizontal in a north- south direction.
A 2 metre pole, marked in 0.5 divisions, was placed vertically at the base of the cliff at the right hand, northern, edge of the viewfinder.

Photograph 1. First pole placement.

Having checked the camera position, the spirit level and focus a photograph was taken. The photograph number for that day, the camera image number, Ordnance Survey National Grid Reference, longitude and latitude, of the camera position, were recorded in the field work book. The camera position, OS grid to 10 figures, longitude and latitude were obtained using a Garmin, Oregon 300 GPS. The GPS compass was calibrated at the start of each photographic session. With the camera still in the original position the pole was moved south until it was at the left hand, southern, extremity of the viewfinder and placed vertically at the base of the cliff.

Photograph 2. Second pole placement

The camera and tripod were then moved south, parallel to the cliff, until the pole could be viewed at the northern edge of the viewfinder. The process was then repeated along the cliff face.

FILING OF THE DATA

The data and photographs are very precious. It would be very frustrating to have to repeat a field trip because they had been lost. They were, therefore, printed, transferred to a computer and backed up on an external hard drive which was then stored in a fireproof safe.

RESULTS

52 successful field trips were made. Several others were aborted due to adverse conditions. 1514 photographs were taken of the 64 kilometres of coast. None was lost.

PROBLEMS ENCOUNTERED IN THE FIELD

There is not a continuous public cliff path along the Holderness coast and access to the beach was, in several places, through private land. On these occasions negotiation for access was required. In all cases an explanation of our purpose was met with acquiescence. However, in some areas access was not allowed. (e.g. MOD). The tides reach the base of the cliffs in many places and it was necessary to consider the tide times and ranges before a proposed

field trip. This calculation was required not only with regard to beach access but also the safe return from the photography site which was, on two occasions, two miles from the access. Despite careful calculation of the tides some field trips were abandoned because storm surges or a strong onshore wind gave a higher tide than anticipated. Strong winds, sand storms, rain and mist caused adverse conditions for photography and required frequent cleaning of the camera lens.
Between Mappleton and Tunstall there is a World War Two firing range. Old ordnance is regularly washed out of the cliff. Most of it is dead but one cannot be certain. It is therefore wise to give any shell cases a wide berth and not to kick them. Minor problems consisted of negotiating fishermen and their lines, sunbathing nudists (not recorded on camera) and the occasional washed up whale.

Photograph 3. A stranded whale.

PROBLEMS ENCOUNTERED WITH PROCESSING THE PHOTOGRAPHS

Panoramas.

It is advantageous, if possible, to join sequential images into a single image or panorama view. When constructing a panorama view of a scene it is necessary to take a sequence of overlapping images with the camera in a fixed position.

Photograph 4. A standard panorama image.

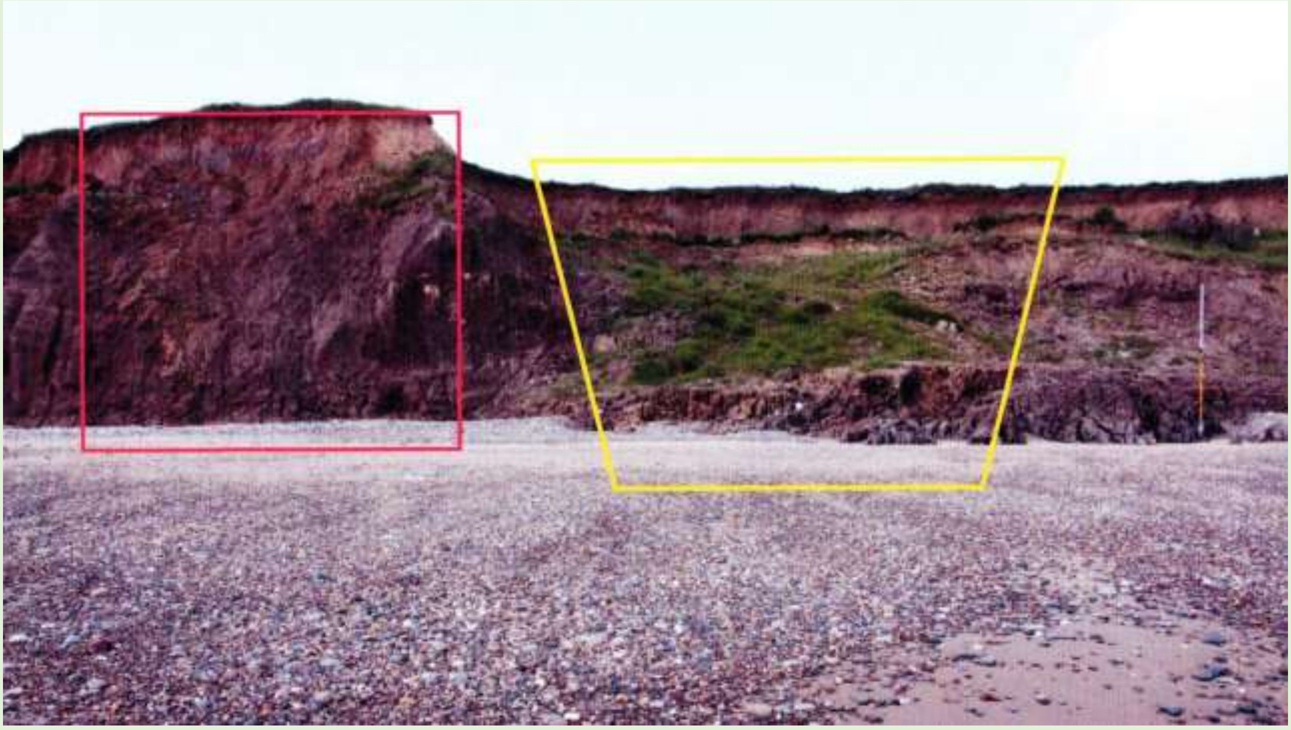
However, we were taking sequential views parallel to the cliff. When it was attempted to blend the images of the same cliff into a panorama, using standard Photoshop software, it was found that the image was distorted and therefore of no value.

Photograph 5. The same panorama using parallel images.

The advice was sought of a professional photographer who confirmed that it would not be possible to construct a panorama image from photographs taken parallel to the cliff. It was suggested that “layering” was tried.

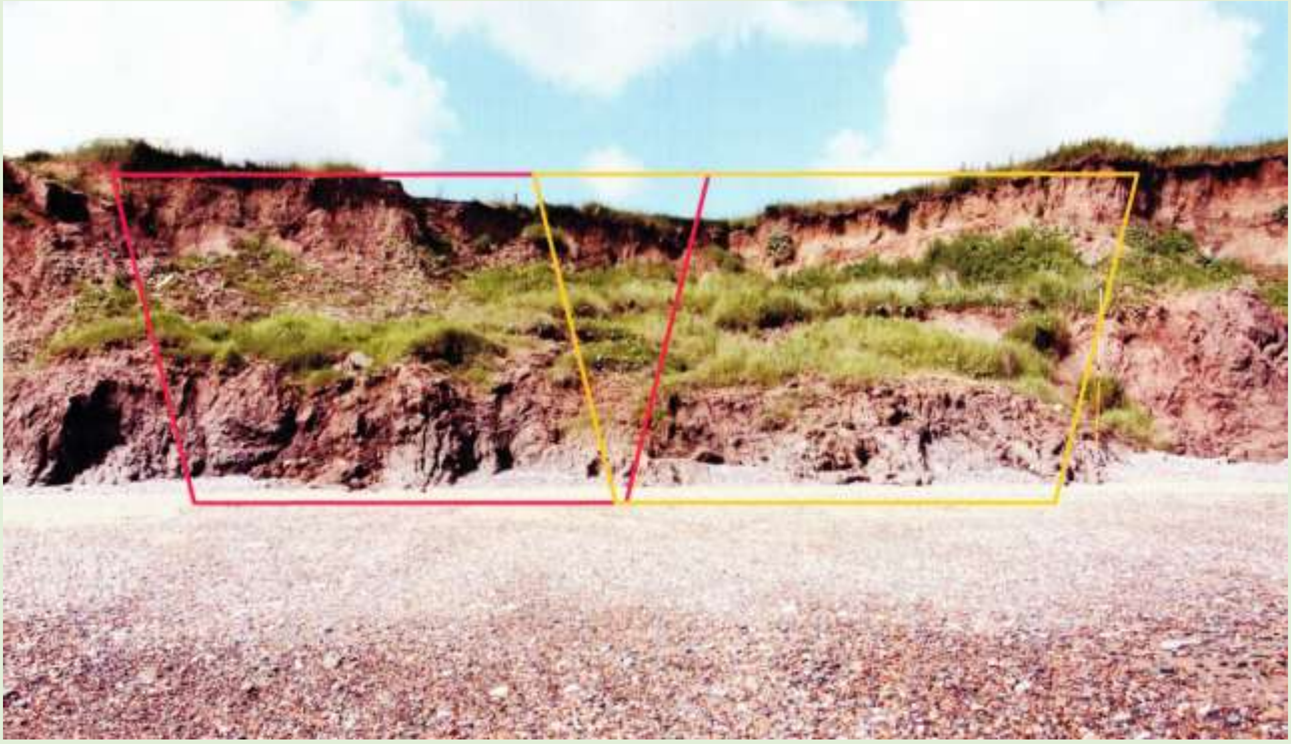
Layering.
This is a digital photography technique. Separate digital photographs are manipulated on computer software to overlap each other. When the correct position has been achieved the images are “flattened” or compressed together to produce one image. Only two images at a time can be processed in this way. There was, therefore, only a minimal benefit and it produced a new abnormality which we called “slope distortion”. When an image of a vertical cliff face is taken

the distances between the camera and cliff base and the camera and cliff top will be different because the camera is at beach level. This is not usually of significance. However, the cliffs of the Holderness coast have slumped seawards so that the base of the cliff may be many metres seaward of the cliff top. When a photograph is taken, 30 paces back from the cliff face, some 35 horizontal metres of the cliff, at beach level, will be captured. However, at cliff top level, because it is much further away, a much greater horizontal distance is captured.



Photograph 6. To show the different images captured
in vertical and slumped cliffs.

Trying to blend or overlap these images results, again, in distortion of the images.



Photograph 7. To show the distortion of image overlap on a slumped cliff face.

Strips.
The possibility of printing the photographs in a continuous strip to permit their examination is being considered. However, in the meantime the photographs will be individually printed and examined in order to select sites for further study. The images will also be examined on a computer screen, where they can be manipulated and magnified to permit detailed examination.

WHY NOT USE A DRONE?

The use of a drone was considered early in the project. It was thought that the continuous moving image provided by a drone would permit a rapid method of recording the cliffs' structure.

However, further investigation revealed the following disadvantages. A drone of sufficient quality is expensive, approximately £1000. It is now also necessary to obtain a licence to fly one and there are legal restrictions as to its use, particularly regarding its proximity to members of the public (Air Navigation Order 2016). Drones additionally have limitations in performance. For stability they should be flown in winds of less than 20 mph, their rotors react poorly to wind-blown sands, the battery life is only 15-20 minutes and wet conditions would fog the lens which cannot be cleaned during flight. These limitations, when added to restrictions caused by the tides, storm surges and adverse weather would add delay to the completion of the project. It was also essential, for the purpose of the project, that each photograph had an accurate OS grid location. It was not certain that this could be programmed into a drone's photograph. It is a frequent assumption that, when using a drone, the cliff faces could be photographed from a cliff top vantage point. However, the majority of the Holderness cliff top is private land and there is therefore no access. We found that we had to obtain permission to access the beach at distant points from the area to be studied and that there were many occasions when the photography site required a walk of one or two miles from the beach access site. A camera and tripod proved a substantial burden on the sand. The weight of a drone would have been more difficult to manage. Our more laborious method did, however, permit the simultaneous close and overall examination of the cliffs by the camera man and the pole man. This would not be possible with a drone. Finally, we encountered many dogs on our trips. An encounter between one of them and the rotors of a drone could result in serious injury.

We concluded that, although the use of a drone may be a consideration in the future, the single overlapping images, which we obtained, were more appropriate for the purposes of this phase of the study.

CONCLUSION

The purpose of this first phase of the Bisat Project was to accurately record the appearances of the cliff faces of the Holderness coast from Sewerby to Spurn. This task, which built on W.S. Bisat's previous work, had not previously been achieved. There were many logistical problems regarding beach access, camera usage, methods of recording data and the processing of photographs which were successfully overcome. The next phase of the Project will consist of the selection of specific sites for detailed examination in order to understand the complex structure and dynamics of the last glaciation.

REFERENCES

Catt J A & Madgett P A 1981. The work of W S Bisat F.R.S. on the Yorkshire Coast. Pp 119-136 of Neal & Fenley (eds). *The Quaternary in Britain*. Pergammon Press. 267pp.

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