

## Summary of Geological History

Over geological time, Fife has experienced volcanoes, deserts, tropical swamps and glaciers. About 410 million years ago (Devonian Period), great volcanic eruptions poured out vast volumes of lava which now form the North Fife Hills. This event was followed by an arid climate which created areas of desert. The rocks underlying Ladybank are mainly red and yellow sandstones of late-Devonian age (about 370 million year old). These rocks were probably formed by rivers flowing through deserts (similar to those in Namibia, S.W. Africa, today). The red colour of the rock indicates that iron minerals coating the sand grains "rusted" after being exposed to the air, a feature typical of deserts.

Later in southern and eastern Fife, about 340 - 300 million years ago during the Carboniferous Period, great river plains and deltas developed which encouraged the creation of tropical swamps where rotting vegetation led to the formation of coal deposits - coal which fed the furnaces of Scotland's Industrial Revolution.

The Devonian sandstones which form the bedrock around Ladybank are mostly covered by widespread deposits of boulder clay, sands and gravels laid down between 26000 - 17000 years ago by westwardly-receding glaciers during the last Ice Age. A glacier, possibly an offshoot of the Forth valley glacier, augmented by southward-moving ice off the Ochil Hills and the Tay Valley glacier bringing rocks from the Highlands, occupied the Howe of Fife. As the ice retreated, melt waters carried sands and gravels which were deposited along their reach. Boulders found today in nearby sand and gravel quarries reflect the rocks over which glaciers once moved.

This cairn is built of locally-quarried red Devonian sandstone (with the exception of the cap stone which is probably Permian sandstone, about 280 million years old, from Dumfriesshire). Twelve rocks collected from a nearby quarry have been built into this memorial cairn. Each one is described here.

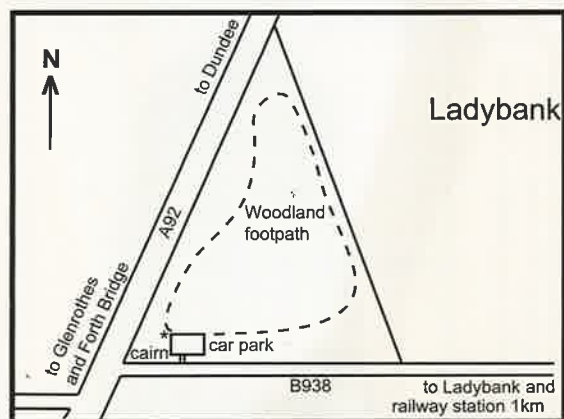
### Bibliography

Armstrong M, Paterson I.B. & Browne, M.A.E. (1985). *Geology of the Perth and Dundee district. Memoir, British Geological Survey, Sheets 48W, 48E, 49.*

Browne, M.A.E., McKirdy, A. & McAdam, D. (2001). *Fife & Tayside - a landscape fashioned by geology.* Scottish Natural Heritage.

MacGregor, A.R. (1996). *Fife and Angus Geology.* 3rd Ed. Pentland Press.

## Locality Map



Maps: OS Explorer 1:25000 No. 370. OS Landranger 1:50000 No. 59  
\* CAIRN - Grid Reference: NO 297 095

Ladybank is served by:  
First Scotrail trains: (Edinburgh - Dundee - Aberdeen)  
and (Edinburgh - Perth).  
Bus services: Stagecoach X54 (Edinburgh - Dundee)  
and F1/F2 (St.Andrews - Newburgh).

## geoHeritage Fife

was set up in 2000 to:

- \* publicise Fife's geological heritage
- \* provide educational resources in geology
- \* promote geotourism

If you would like to assist with these aims, consider joining the group by contacting: **geoHeritage Fife** 01334 828623.

## Fife RIGS

RIGS are Regionally Important Geological (and Geomorphological) Sites.

The scheme was devised to encourage local involvement in the identification, designation, monitoring and preservation of sites of local and national educational and scientific importance. Fife RIGS is concerned with notifying Fife Council planning authority about these sites.

Fife RIGS was incorporated into **geoHeritage Fife** in December 2005.

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## Geology of Ladybank - a record in stone



*To augment the creation of the Alan Crawford Memorial Walk by the local Rotary Club, a cairn has been erected in his memory. It is built of 370-million-year-old sandstone which forms the bedrock beneath Ladybank. The cairn contains twelve different glacially-transported rocks collected from a local quarry. This leaflet describes the geological history of the Ladybank area, how the rocks were formed, how old they are and where they came from.*



geoHeritage Fife  
(incorporating  
Fife RIGS)



**Hanson**

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## Cairn (left side)



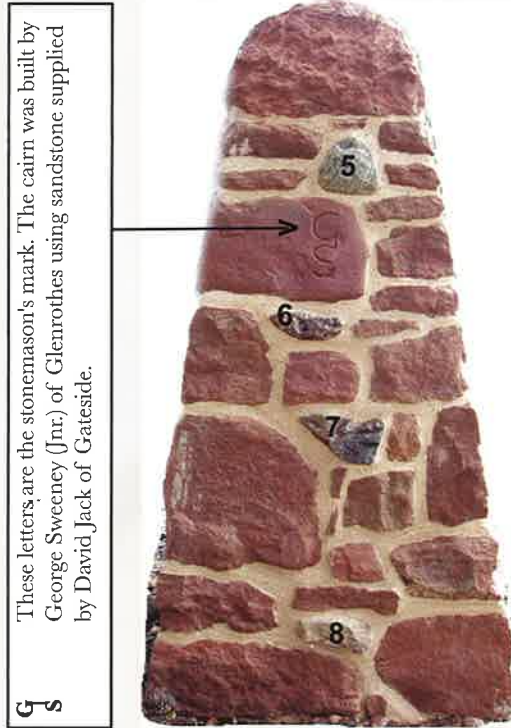
1. **FELSITE.** An igneous rock rich in silica, it is found today at Balmullo Quarry, Balmullo, and Peaceshill Point near Wormit. This rock was formed about 410 million years ago during the Devonian period when molten rock squeezed its way into the overlying Devonian lavas of the North Fife Hills.

2. **SCHIST.** This rock, of Dalradian age, came from the Highlands. It formed originally about 600 million years ago as a muddy rock, which was later "cooked" about 480 million years ago, under high temperature and pressure - a process called metamorphism. The greenish colour is due to the presence of an iron-magnesium silicate mineral called chlorite.

3. **SANDSTONE.** This dark purplish-brown sandstone is about the same age as the red sandstones of the cairn (370 million years old) but contains fragments of lava eroded off the North Fife lavas.

4. **QUARTZITE.** This rock represents a sandstone which was laid down about 600 million years ago, then "cooked" about 480 million years ago to the point where each sand grain has partially melted and fused with its neighbour. It has come from the Highlands.

## Cairn (rear)



5. **GNEISS.** This rock was formed at higher pressure and temperature than the schist (2). The coarse banding formed by the segregation of iron-rich and iron-poor minerals at depths of over 20km and at temperatures exceeding 750°C. It could have come from the Grampians.

6. **VESICULAR ANDESITE.** This volcanic rock cooled from the liquid state. Gas bubbles formed cavities which were later filled by agate - seen here forming small pink and red clusters of silica. This rock resembles the Devonian lavas of North Fife, so probably has not travelled very far.

7. **BASALT.** This is a fine-grained equivalent of the North Fife Devonian lavas. It would have cooled rapidly from the liquid state at about 1200°C which prevented the formation of large crystals.

8. **SANDSTONE.** This pale sandstone contains thin layers of soft greenish mudstone. This rock is of similar age to the red sandstone, but might have formed in quiet or slack river water conditions where mud could accumulate.

## Cairn (right side)



9. **PSAMMITE.** This represents a sandstone which has been heated to a lesser degree than the quartzite (4). Coarse banding can be seen which may represent original layering. It is likely to have come from the Highlands and is over 480 million years old.

10. **BLUE GRITSTONE.** This is a Highland (Dalradian) rock formed over 480 million years ago from a muddy sandstone. Its dark colour is due to a mixture of iron- and magnesium-rich silicate minerals (chlorite and biotite). It is coarser than the schist (2). Two quartz veins cut through it.

11. **PORPHYRITIC ANDESITE.** This volcanic rock from the North Fife hills contains many small white crystals of the mineral feldspar, a sodium-calcium-aluminium silicate. The presence of crystals suggests this rock cooled more slowly than the basalt (7).

12. **CONGLOMERATE.** This rock contains pebbles of older rocks and is a natural "concrete". The purple-brown colour suggests that it may have formed from pebbles and finer material carried by rivers flowing off the North Fife lava hills, some time after they had formed.