

DISPLAY G2

Sub-basalt imaging – new insight from investigations of petrophysical and seismic properties of Faroes basalts (SeiFaBa project)

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The development of methods of seismic imaging beneath basalt is still hindered by a lack of knowledge about the elastic properties of basaltic sequences and the degree of three-dimensional heterogeneity. The SeiFaBa project (2002-2005) is funded by the Sindri Group as part of the programmes for licensees within the Faroese area and will address these issues.

The first year included drilling of a new 700-m deep well, Glyvursnes-1, near Tórshavn with full core, reaming of the existing 660 m deep Vestmanna-1 well farther north, and the acquisition of a wide range of wireline logs in both wells. The two wells represent almost half of the exposed lava sequence and are central to a number of co-ordinated experiments. These are targeted at creating firm data-derived models for seismic wave propagation through basalt by combining detailed analysis at core, log and seismic scales. After initial tests in 2002 the main part of the seismic programme was carried out June to September 2003. The work was centred on Glyvursnes-1 and included both VSP, offset-VSP and surface seismic experiments.

Detailed studies of well logs and core material from the above and other wells have been initiated. The aim is to better understand the sonic response of basalt lavas in terms of physical and compositional properties and thus also seismic signatures of flood basalt successions.

Plate A

Well: Faroes Glyvursnes-1 Interval: 1.8 m – 10.95 m

Upper Basalt Formation

1.8 – 7.0 m: Massive, finely plagioclase-phyric basalt (lower part of lava core).

7.0 – 7.05 m: Moderately vesicular basalt (basal zone of lava flow). The gas vesicles are filled with white zeolites.

7.05 – 7.95 m: Reddish brown, laminated tuff.

7.95 – 8.15 m: Reddish brown, rubbly, aphyric basalt (lava top).

8.15 – 9.0 m: Moderately vesicular basalt (lava crust). The vesicles decrease in abundance and increase in size downwards and are mostly filled with zeolites. The lava contains a few phenocrysts of plagioclase.

9.0 – 10.95: Sparsely vesicular, aphyric basalt (part of lava core). The upper part contains two megavesicles lined with secondary minerals.

Plate B

Well: Faroes Glyvursnes-1 Interval: 29.4 m – 38.3 m

Upper Basalt Formation

29.4 – 29.55 m: Rubbly, slightly plagioclase-olivine-phyric basalt (lower part of basal zone).

29.55 – 32.85 m: Rubbly basalt (upper part of lava crust). Zeolites partly fill the voids.

32.85 – 34.9 m: Moderately to sparsely vesicular basalt (lower part of lava crust).

34.9 – 38.15 m: Sparsely vesicular basalt (lava core). Vesicles are filled with smectite.

38.15 – 38.3 m: Highly vesicular basalt (upper part of basal zone).

N.B. The above lava flow only contains sparse (<1%) phenocrysts of plagioclase and microphenocrysts of olivine (altered). Vesicles and voids are partly empty (water-filled). The basal zone extends 0.45 m into the next core box (not on display) resting on a 5-m thick bed of brownish tuff.

Plate C

Well: Faroes Glyvursnes-1 Interval: 526.6 m – 536.0 m

Middle Basalt Formation

526.6 – 527.4 m: Vesicular aphyric basalt (almost one complete flow-unit).

527.4 – 528.7 m: Vesicular, aphyric basalt (lava crust).

528.7 – 529.9 m: Massive, aphyric to slightly plagioclase-phyric basalt (lava core).

529.9 – 530.4 m: vesicular, plagioclase-phyric basalt (basal zone).

530.4 – 534.4 m: Vesicular, aphyric to highly plagioclase-phyric basalt (one flow?) The upper metre contains 15-25 cm thick pahoe-hoe toes (lava tongues) with a skin of altered glass (dark smectite-rich bands). The flow is chock-full of cm-large plagioclase phenocrysts below 531.7 m suggesting that they accumulated by crystal settling during the eruption.

534.4 – 536.0 m: Flow-units of vesicular, aphyric basalt.

Display G2 Plate A

Well Faroes Glyvursnes-1

1.8 2.65 3.55 4.45 5.35 6.25 7.15 8.05 9.1 10.0



Core photography and digital processing by
Robert Leppard (Leppard Sedimentology Ltd)
and
Colin Oakman (Colin Oakman Associates)



Display G2 Plate B

Well Faroes Glyvursnes-1

29.4 c.30.3 c.31.1 c.31.9 c.32.9 33.8 34.75 35.75 36.6 37.45

Core photography and digital processing by
Robert Leppard (Leppard Sedimentology Ltd)
and
Colin Oakman (Colin Oakman Associates)

KODAK Color Control Patches

Blue

Cyan

Green

Yellow

Pink

Magenta

White

3/Color

Black

KODAK Gray Scale

A

1

2

3

4

5

6

8

9

10

11

12

13

14

15

B

17

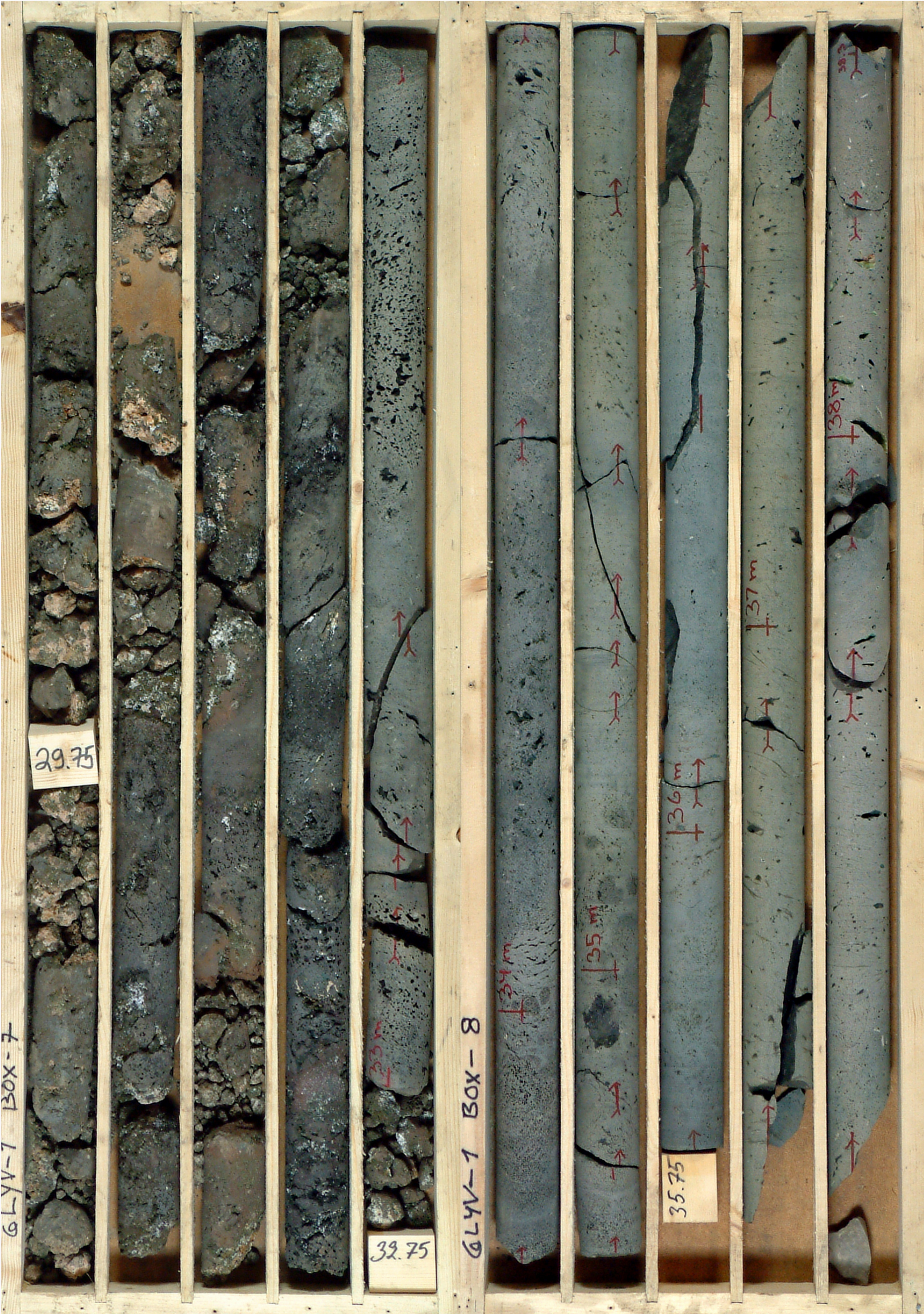
18

19

decimal feet

inches

cm



Display G2 Plate C

Well Faroes Glyvursnes-1

526.6 527.6 528.5 529.45 530.4 531.3 532.3 533.25 534.15 535.15

Core photography and digital processing by
Robert Leppard (Leppard Sedimentology Ltd)
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KODAK Color Control Patches

Blue

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White

Black

KODAK Gray Scale

A

1

2

3

4

5

6

M

8

9

10

11

12

13

14

15

B

17

18

19

decimal feet

inches

cm

All depths in metres

The photograph shows two rows of sediment core sections, labeled 'GLYV-1 BOX-115' and 'GLYV-1 BOX-116'. Each section is a dark, cylindrical core held in a wooden frame. Red arrows and numbers indicate depth intervals. The top row of boxes (115) has labels: 526.6, 527.6, 528.5, 529.45, 530.4. The bottom row of boxes (116) has labels: 531.3, 532.3, 533.25, 534.15, 535.15. Small white labels with black text are placed on some sections: '527.90' on the second section of box 115, and '530.90' and '533.90' on sections of box 116. The sediment is dark gray/black with some lighter, silty or sandy areas visible.