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**Appendix - A**

**Failed and stable cases of Indian coalfields**

Table A.1 Failed cases of pillar from Indian coal mines

Case No.	Mine (seam)	D (m)	h (m)	w (m)	B (m)	w/h	$\sigma_c$
1	Amritnagar (Nega Jamehari)	30	4.5	3.6	5.7	0.8	45
2	Amritnagar (Nega Jamehari)	30	6.0	3.6	5.4	0.6	45
3	Begonia (Begonia)	36	3.0	3.9	6.0	1.3	26
4	Amlai (Burhar)	30	5.4	4.5	4.5	0.8	25
5	Sendra Bansjora (X)	23	8.1	4.65	5.55	0.6	24
6	W. Chirimiri (Main)	90	3.75	5.4	6.0	1.4	45
7	Birsingpur (Johilla top)	129	3.6	7.5	6.0	2.1	38
8	Pure Kajora (Lower Kajora)	54	3.6	5.4	6.0	1.5	33
9	Pure Kajora (Lower Kajora)	56	3.6	4.95	6.45	1.4	33
10	Shankarpur (Jambad bottom)	42	4.8	4.5	4.5	0.9	47
11	Ramnagar (Begunia)	70	1.8	2.85	3.15	1.6	26
12	Ramnagar (Begunia)	51	1.8	3.0	3.6	1.7	26
13	Kankanee (XIII)	160	6.6	19.8	4.2	3	27
14	Kankanee (XIV)	140	8.4	18.6	5.4	2.2	25

Table A.2 Stable cases of pillar from Indian coal mines

Case No.	Mine (seam)	D (m)	h (m)	w (m)	B (m)	w/h	$\sigma_c$
1	Bellampalli (Rossi)	36	3.0	5.4	6.0	1.8	48
2	Nimcha (Nega)	48	6.0	9.9	6.0	1.7	50
3	Morganpit (Salarjung)	270	3.0	8.1	3.6	2.7	46
4	Ramnagar (Ramnagar)	75	2.7	9.9	6.6	3.7	28
5	Lachhipur (Lower Kajora)	38	5.1	7.2	3.9	1.4	33
6	N. Salanpur (X)	30	5.1	9.0	6.0	1.8	21
7	Bankola (Jambad top)	102	4.8	10.1	2.4	2.1	35
8	Bankola (Jambad top)	75	3.0	6.3	4.2	2.1	35
9	Surakacchar (G-I)	106	3.5	16.0	4.0	4.6	29
10	Lachhipur (Lower Kajora)	38	5.1	18.3	4.2	3.6	33
11	E. Angarapatra (XII)	30	2.1	6.0	6.0	2.9	19
12	Kargali Incline (Kathara)	36	3.6	9.3	5.7	2.6	40
13	Jamadoba 6 and 7 Pits (XVI)	80	2.0	5.8	5.5	2.9	29
14	Topsi (Singharan)	85	1.8	7.0	3.9	3.9	41

Table A.3 Factor of safety (*FOS*) of failed cases of pillars

Case No.	Mine (seam)	Stress (Tributary area load)	Strength (numerical simulations)	FOS
1	Amritnagar (Nega Jamehari)	5.01	4.91	0.98
2	Amritnagar (Nega Jamehari)	4.69	4.80	1.02
3	Begonia (Begonia)	5.80	4.08	0.70
4	Amlai (Burhar)	3.00	3.53	1.18
5	Sendra Bansjora (X)	2.77	3.38	1.22
6	W. Chirimiri (Main)	10.03	5.38	0.54
7	Birsingpur (Johilla top)	10.45	5.43	0.52
8	Pure Kajora (Lower Kajora)	6.02	4.62	0.77
9	Pure Kajora (Lower Kajora)	7.43	4.5	0.61
10	Shankarpur (Jambad bottom)	4.20	5.11	1.22
11	Ramnagar (Begunia)	7.76	4.6	0.59
12	Ramnagar (Begunia)	6.17	4.7	0.76
13	Kankanee (XIII)	5.88	5.83	0.99
14	Kankanee (XIV)	5.83	4.43	0.76

Table A.4 Factor of safety (*FOS*) of stable cases of pillars

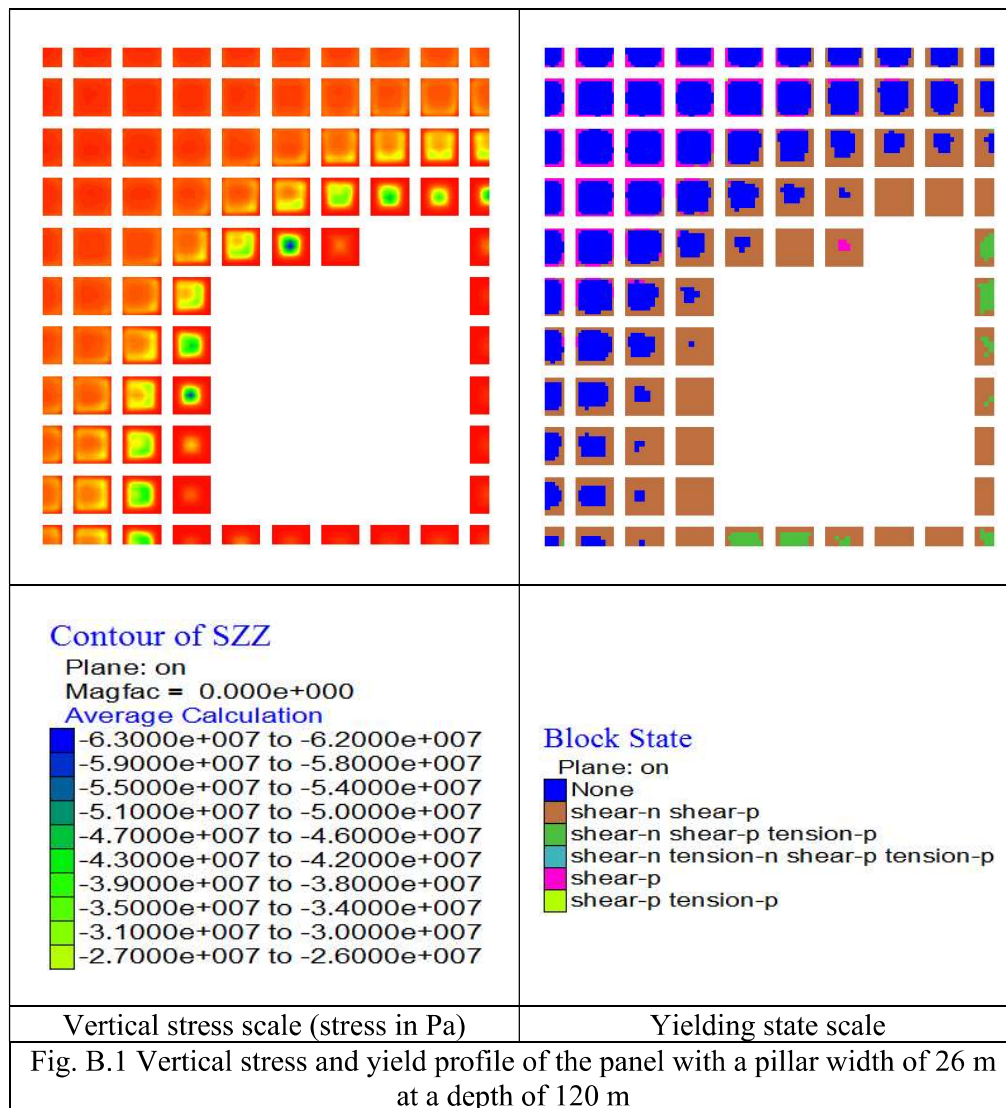
Case No.	Mine (seam)	Stress (Tributary area load)	Strength (numerical simulations)	FOS
1	Bellampalli (Rossi)	4.01	5.95	1.48
2	Nimcha (Nega)	3.10	5.70	1.84
3	Morganpit (Salarjung)	14.08	6.68	0.47
4	Ramnagar (Ramnagar)	5.21	6.68	1.28
5	Lachhipur (Lower Kajora)	2.26	4.43	1.96
6	N. Salanpur (X)	2.08	3.88	1.86
7	Bankola (Jambad top)	3.91	5.18	1.33
8	Bankola (Jambad top)	5.21	5.39	1.03
9	Surakacchar (G-I)	4.14	29.9	7.22
10	Lachhipur (Lower Kajora)	1.44	6.84	4.76
11	E. Angarapatra (XII)	3.00	5.16	1.72
12	Kargali Incline (Kathara)	2.34	6.06	2.59
13	Jamadoba 6 and 7 Pits (XVI)	7.59	5.98	0.79
14	Topsi (Singharan)	5.15	8.37	1.62

## **Appendix – B**

### **Simulation results of the unstable cases concerning panel design**

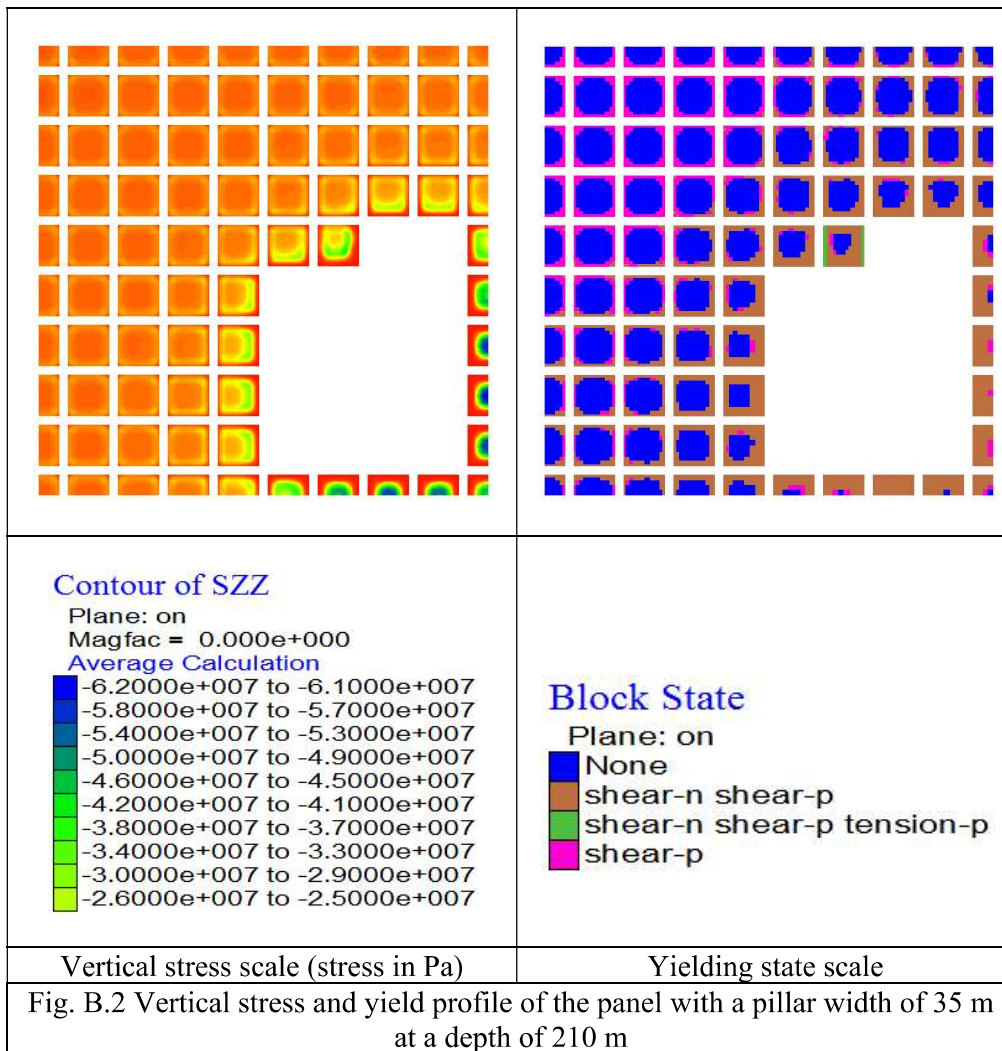
### Appendix – B1

#### Simulation results concerning panel design for a pillar width of 26 m



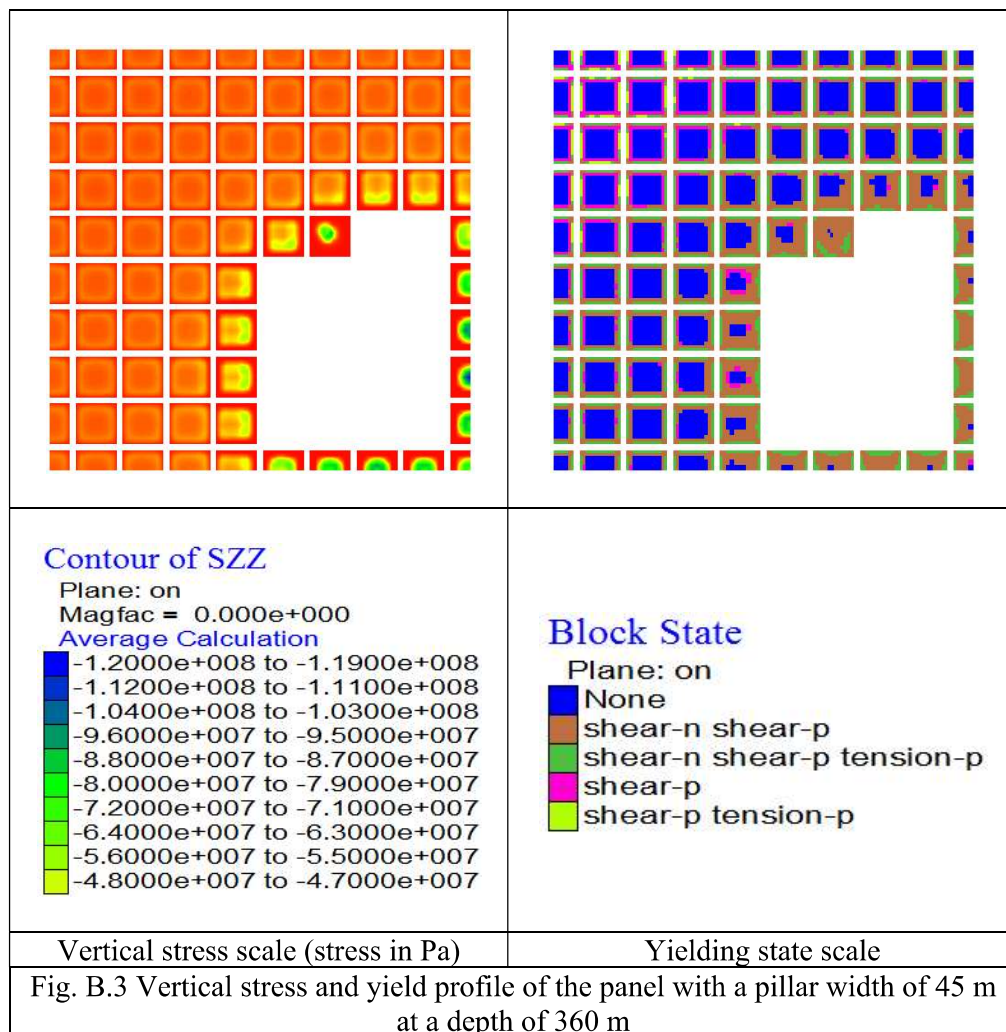
Appendix – B2

Simulation results concerning panel design for a pillar width of 35 m



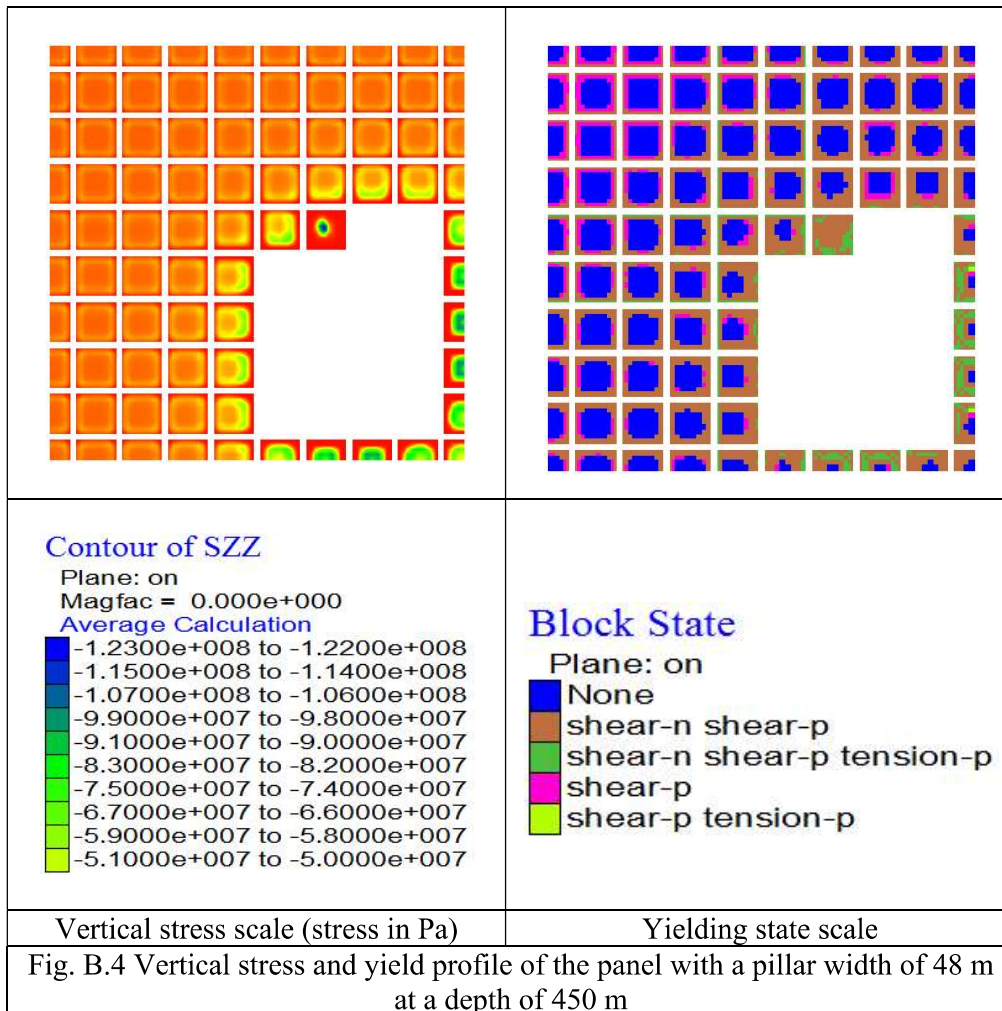
### Appendix – B3

#### Simulation results concerning panel design for a pillar width of 45 m



Appendix – B4

Simulation results concerning panel design for a pillar width of 48 m

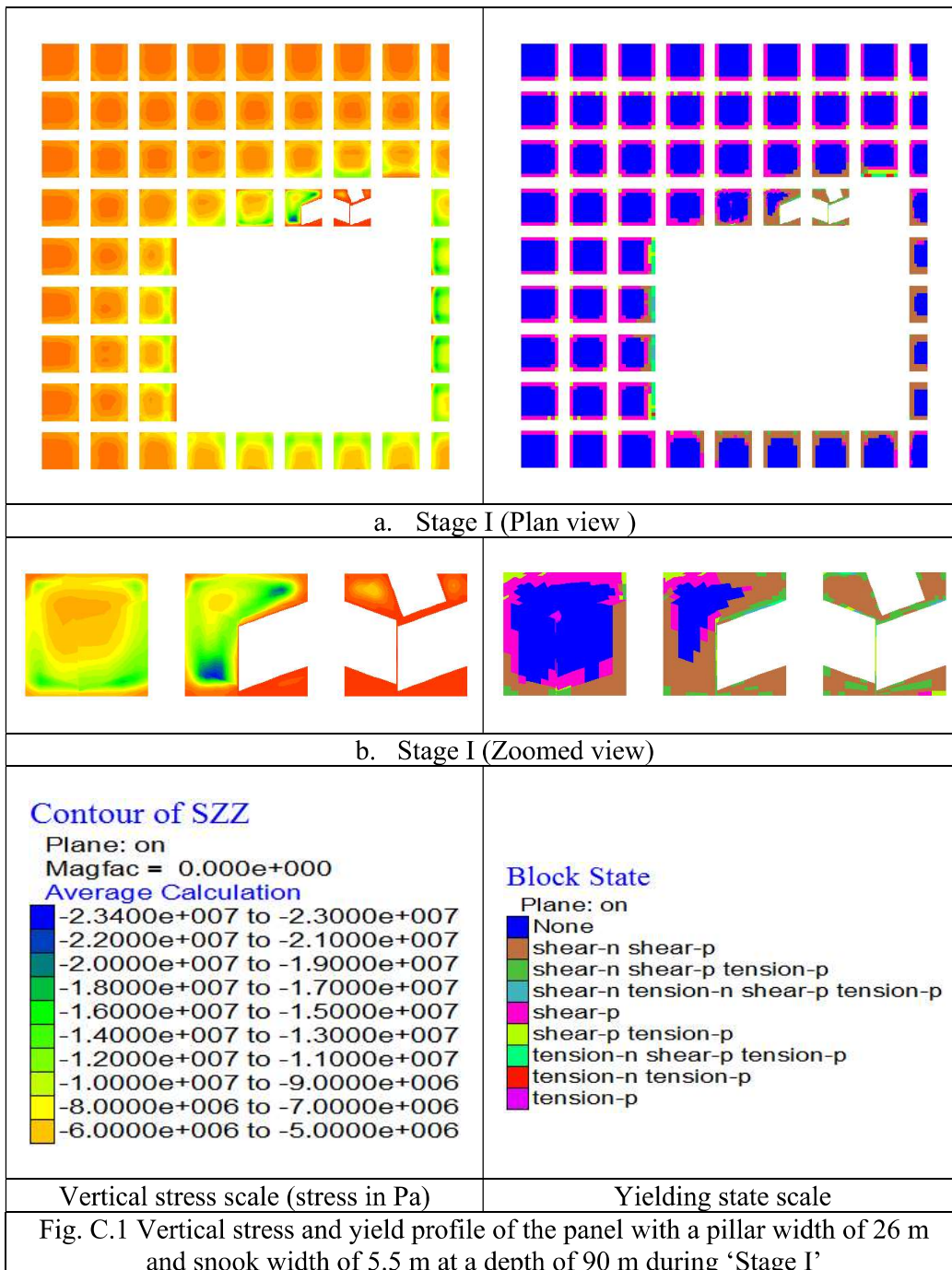


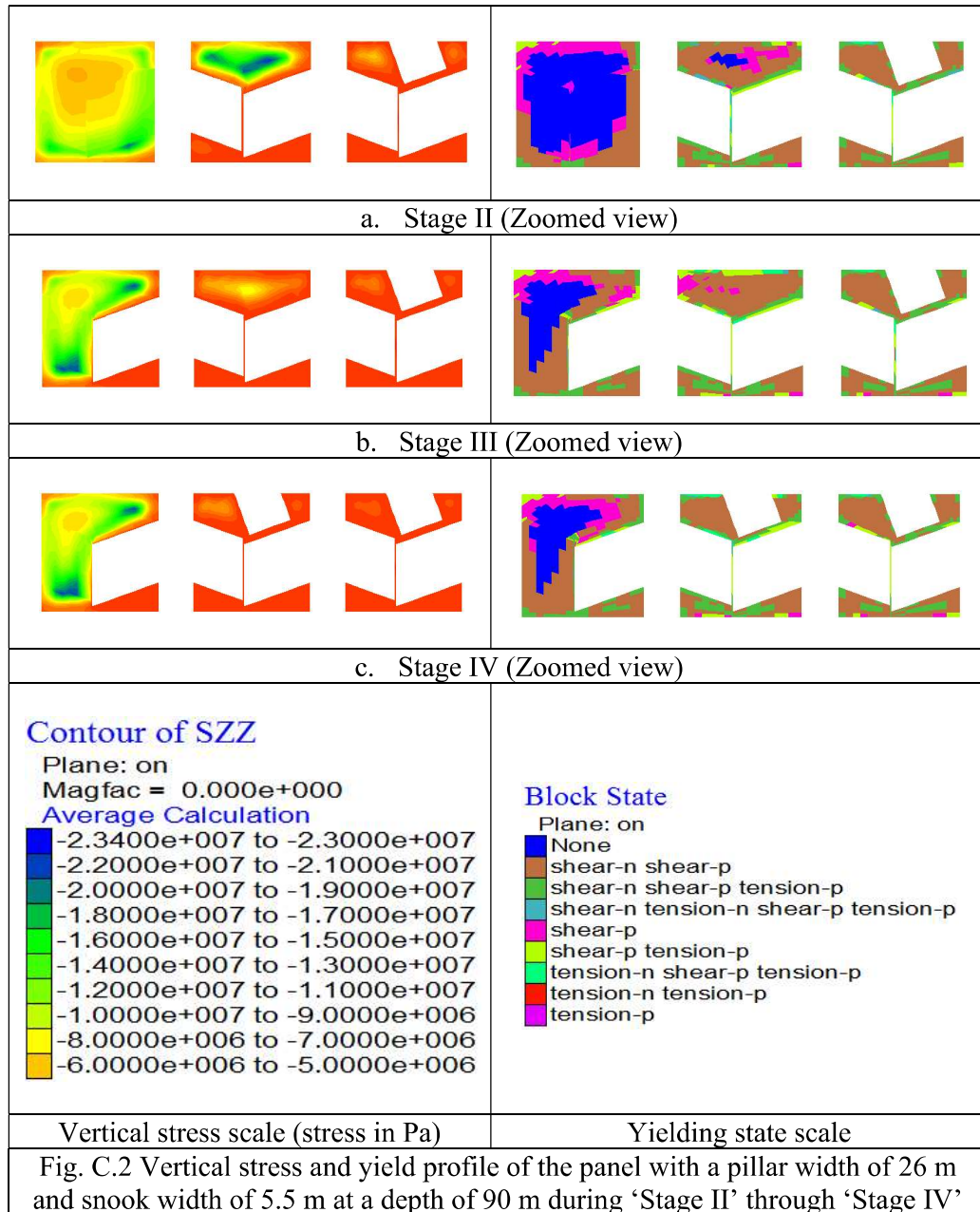
## **Appendix – C**

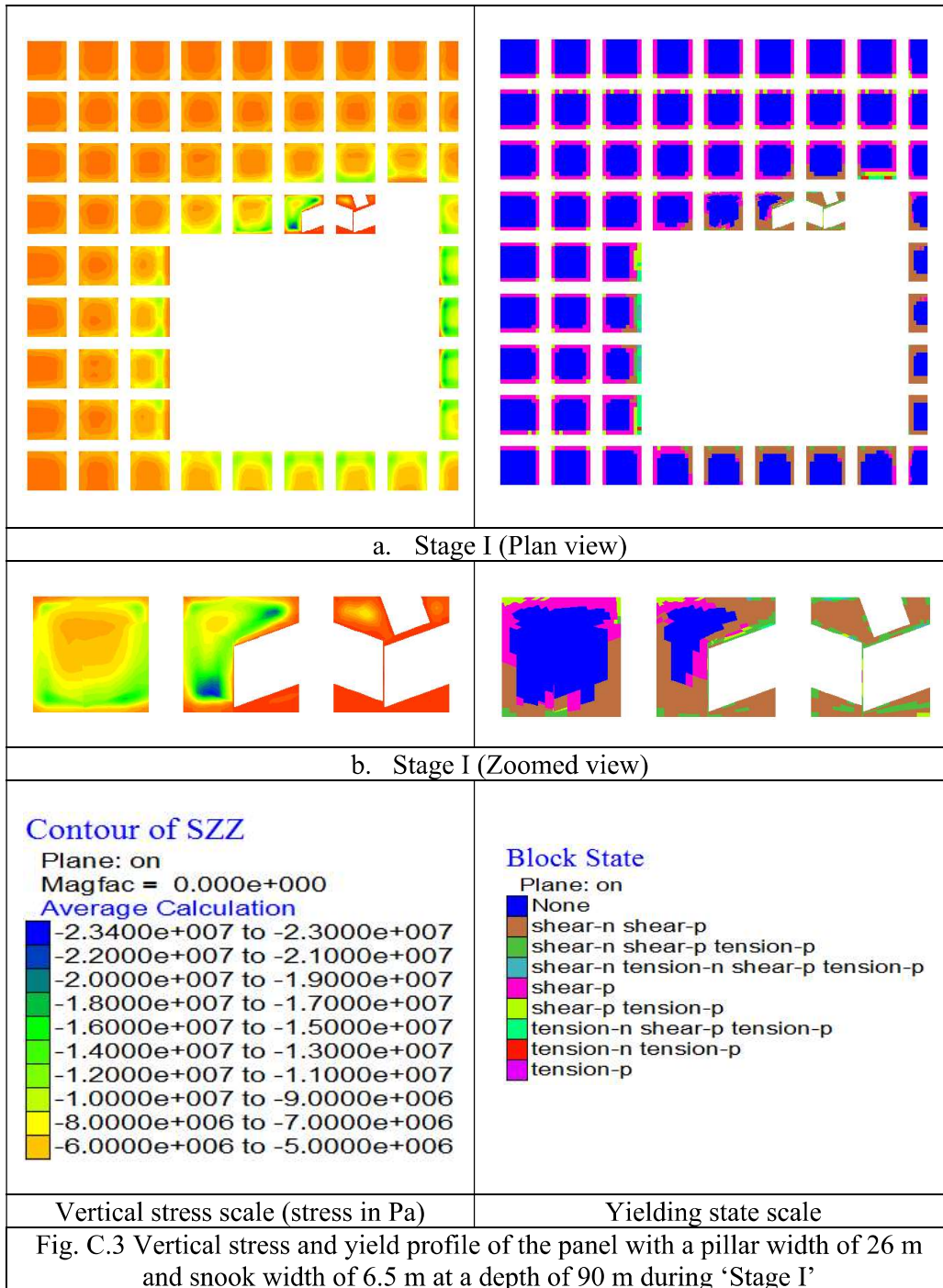
### **Simulation results concerning remnant pillar design**

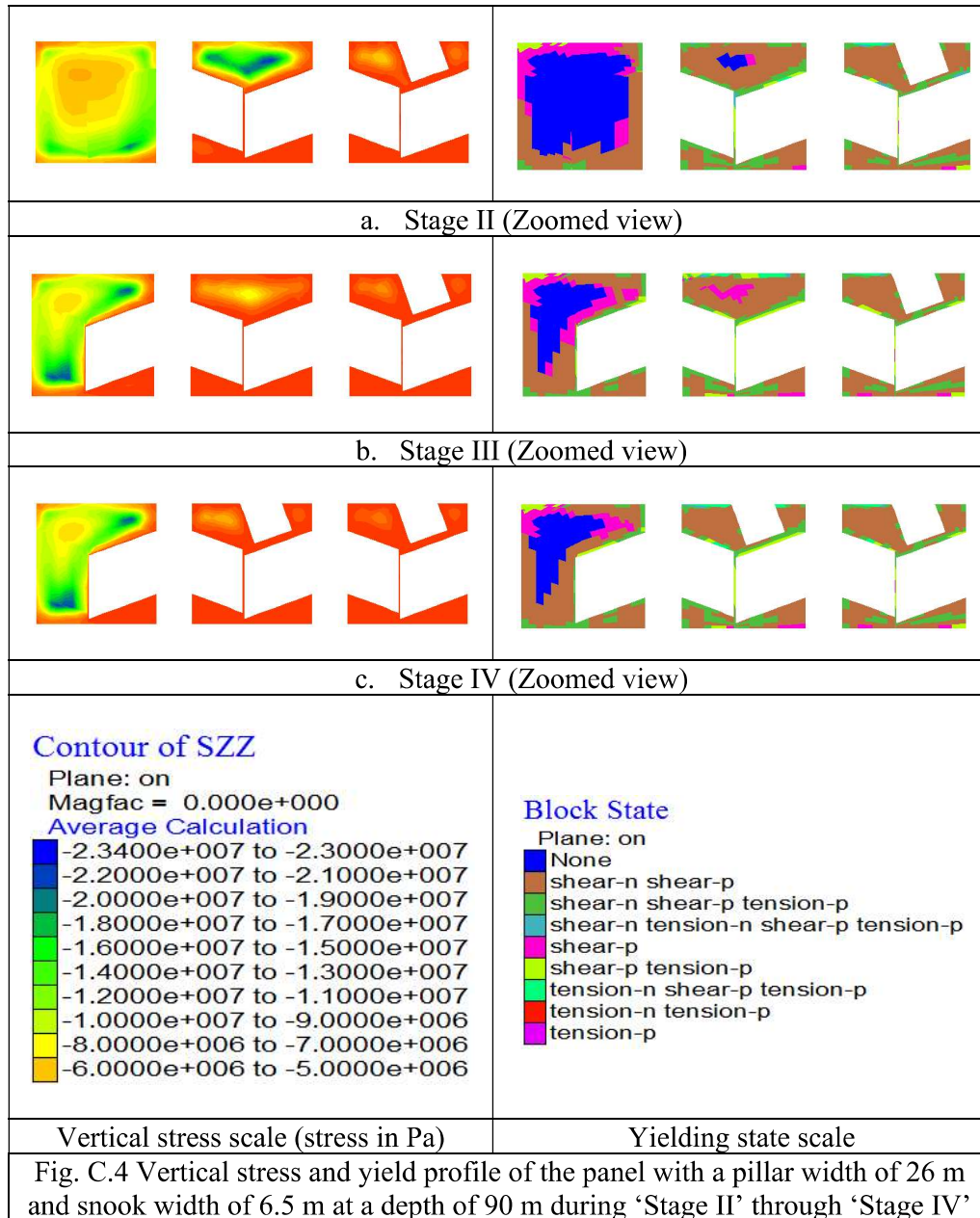
Appendix – C1

Simulation results concerning remnant pillar for a pillar width of 26 m



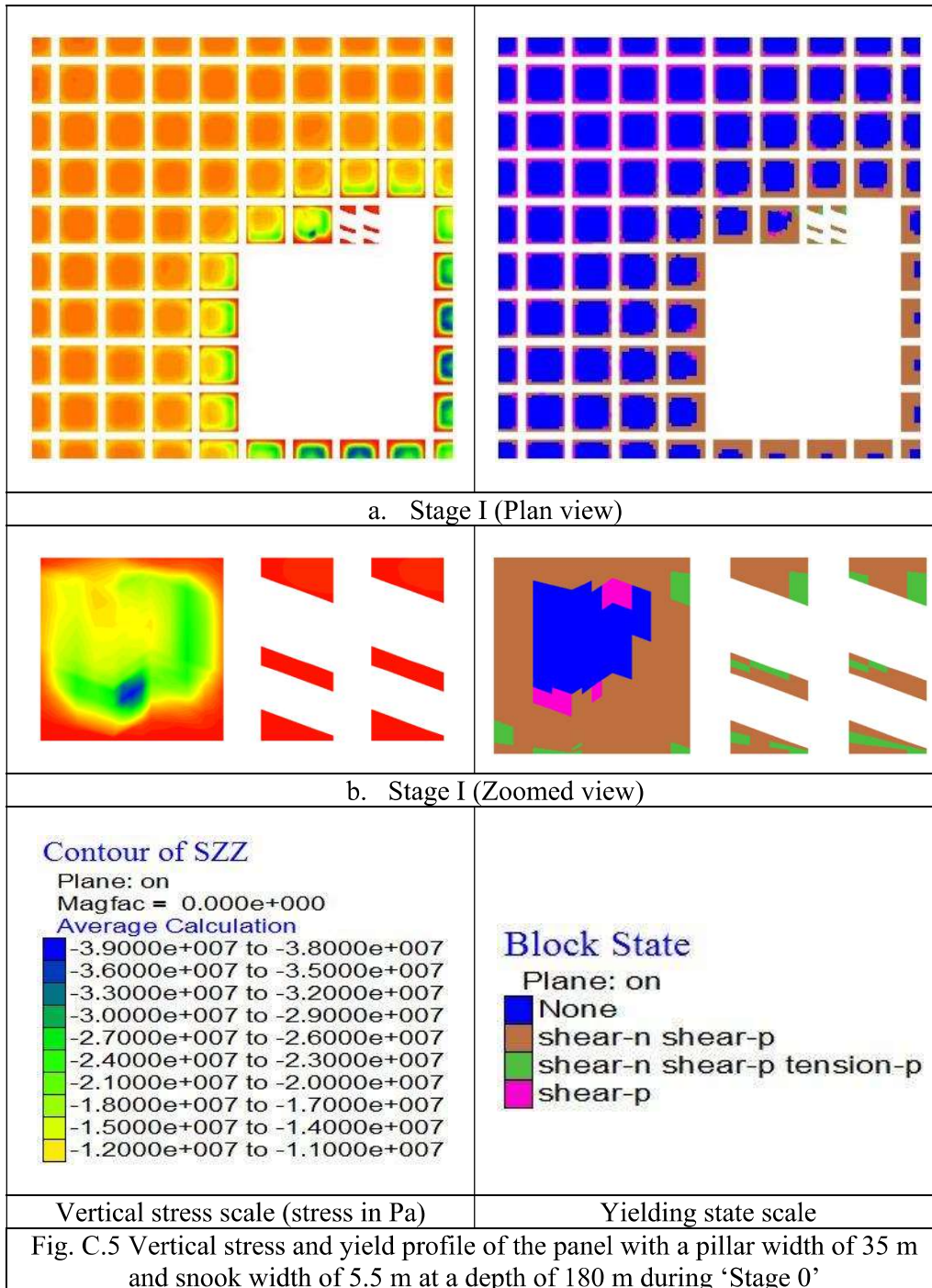


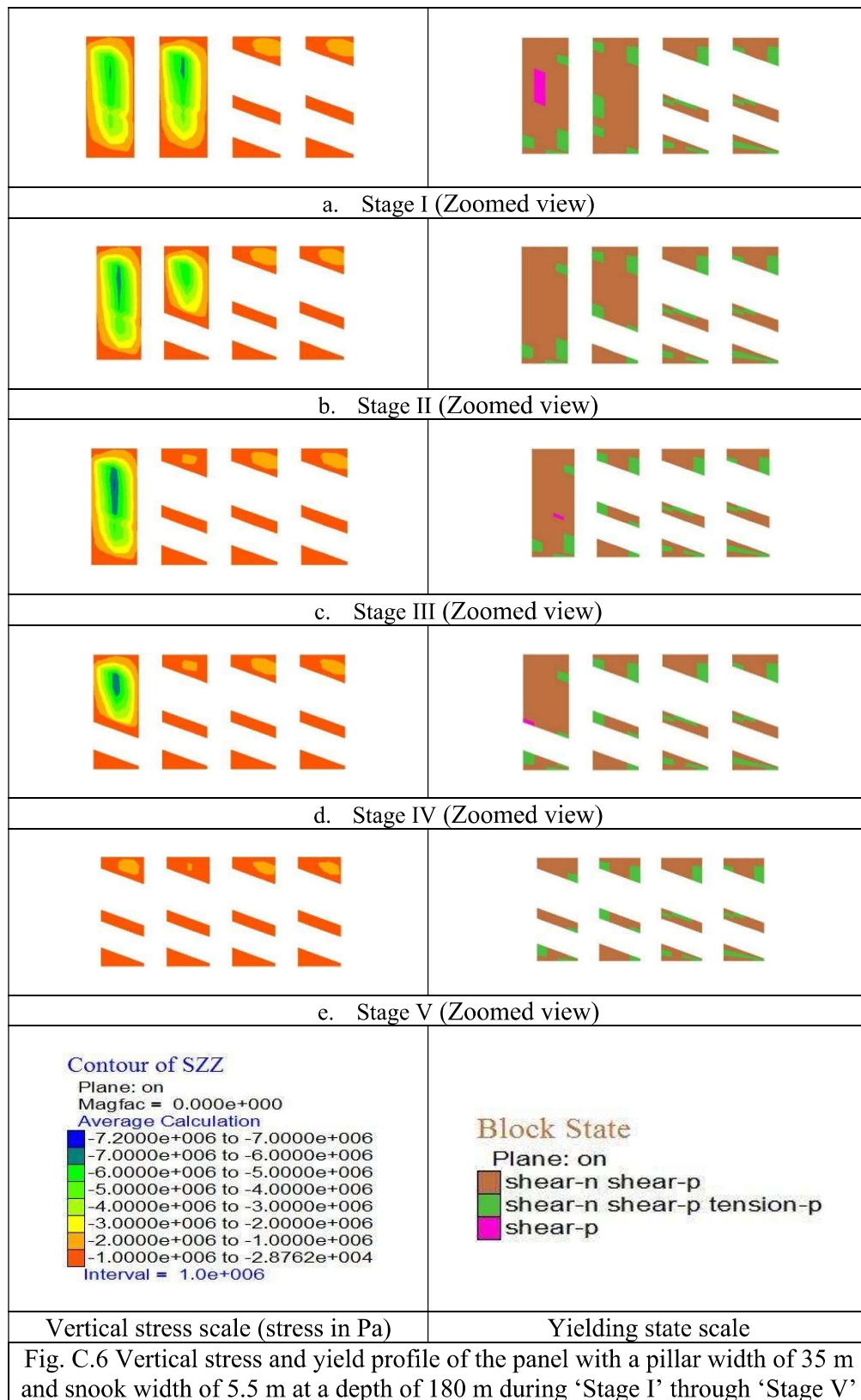


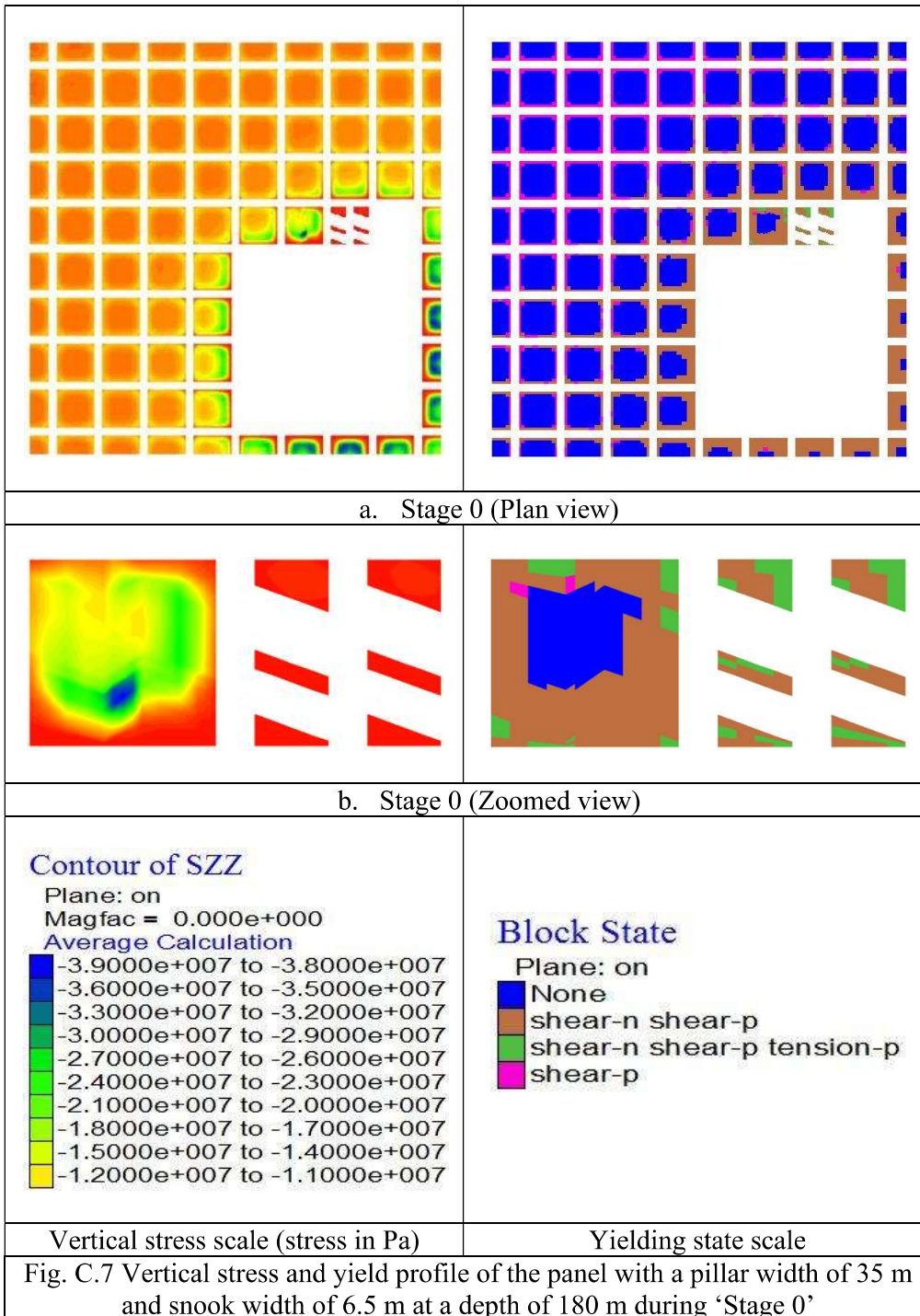


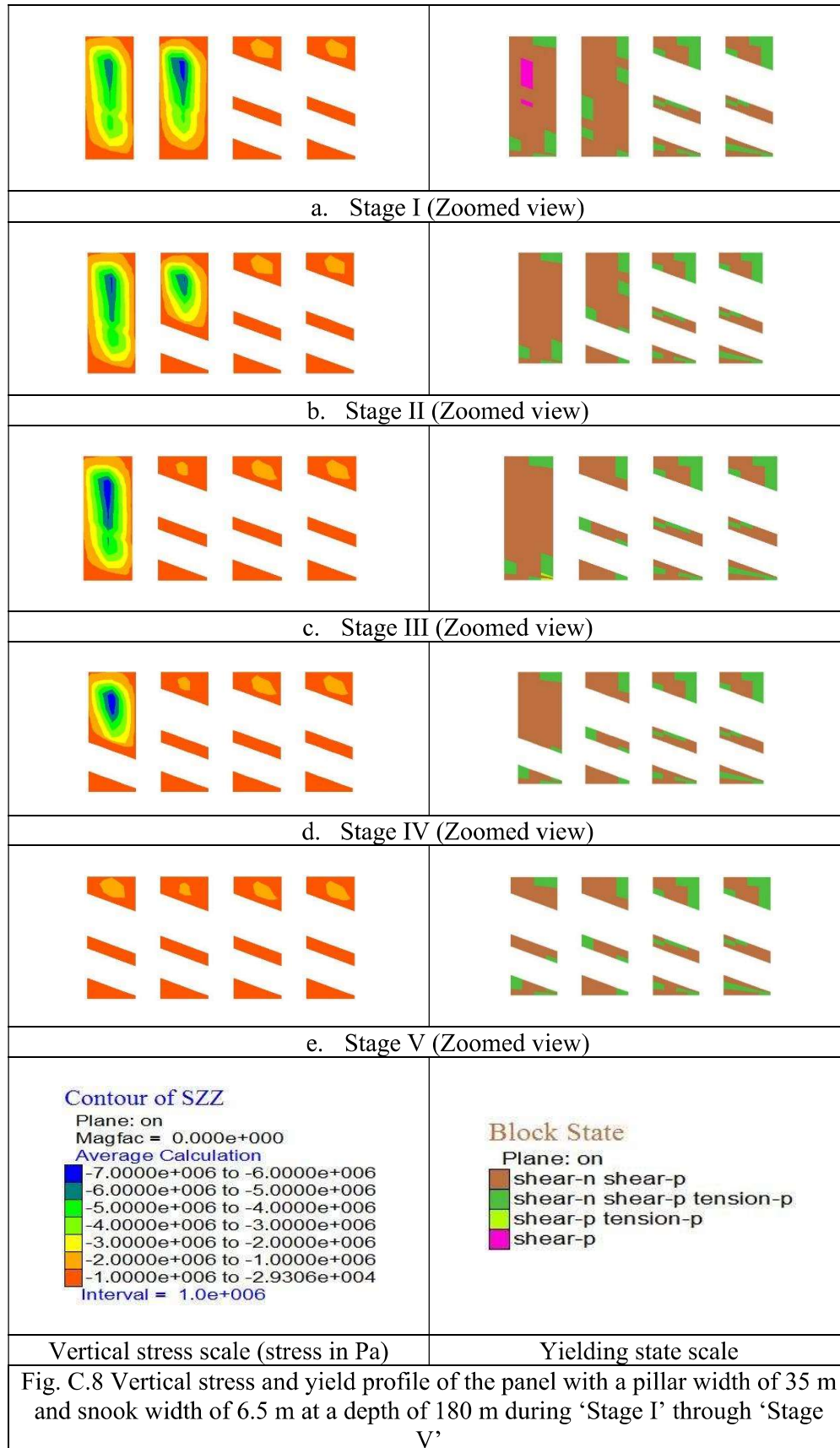
## Appendix – C2

### Simulation results concerning remnant pillar for a pillar width of 35 m



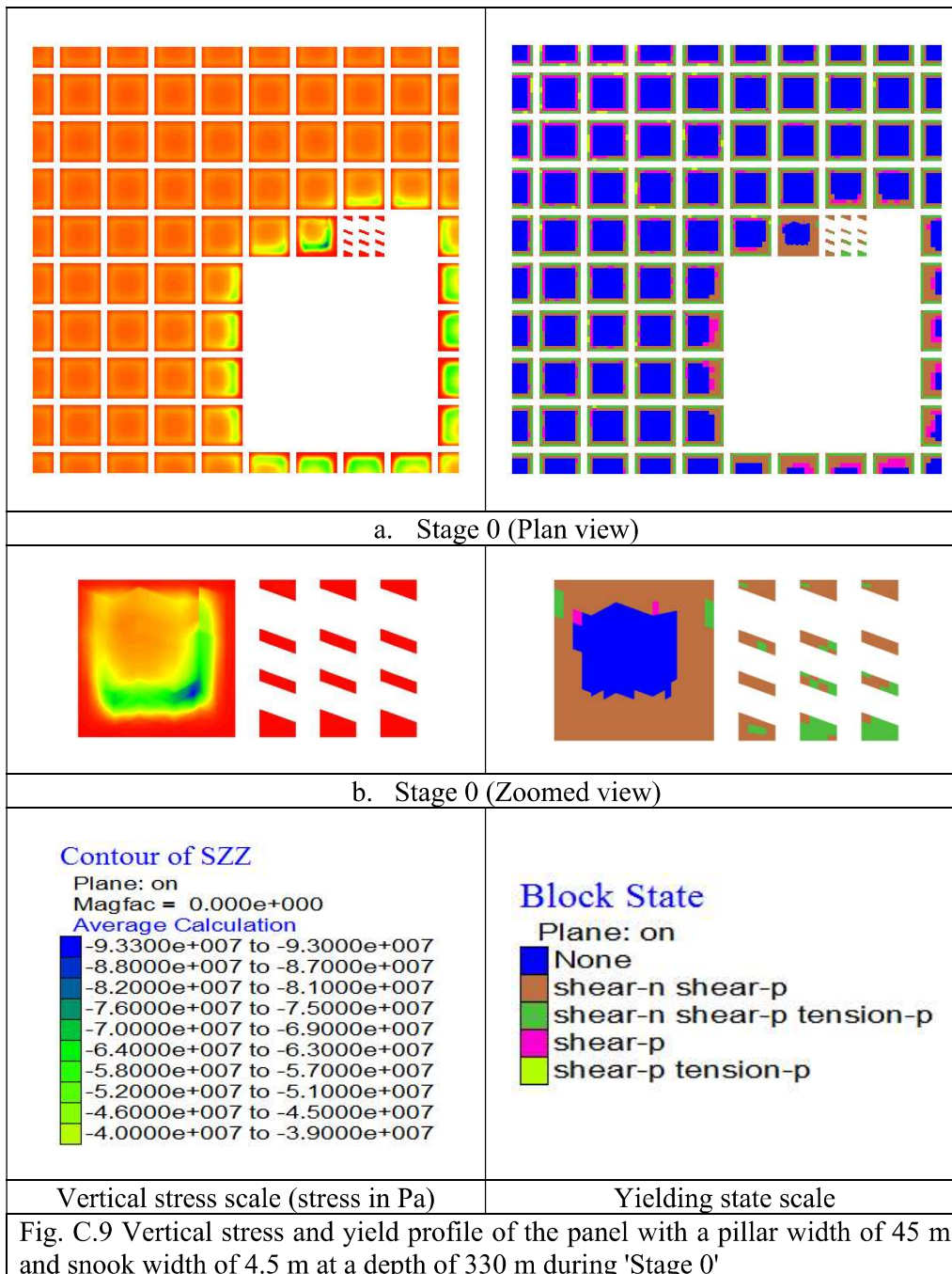


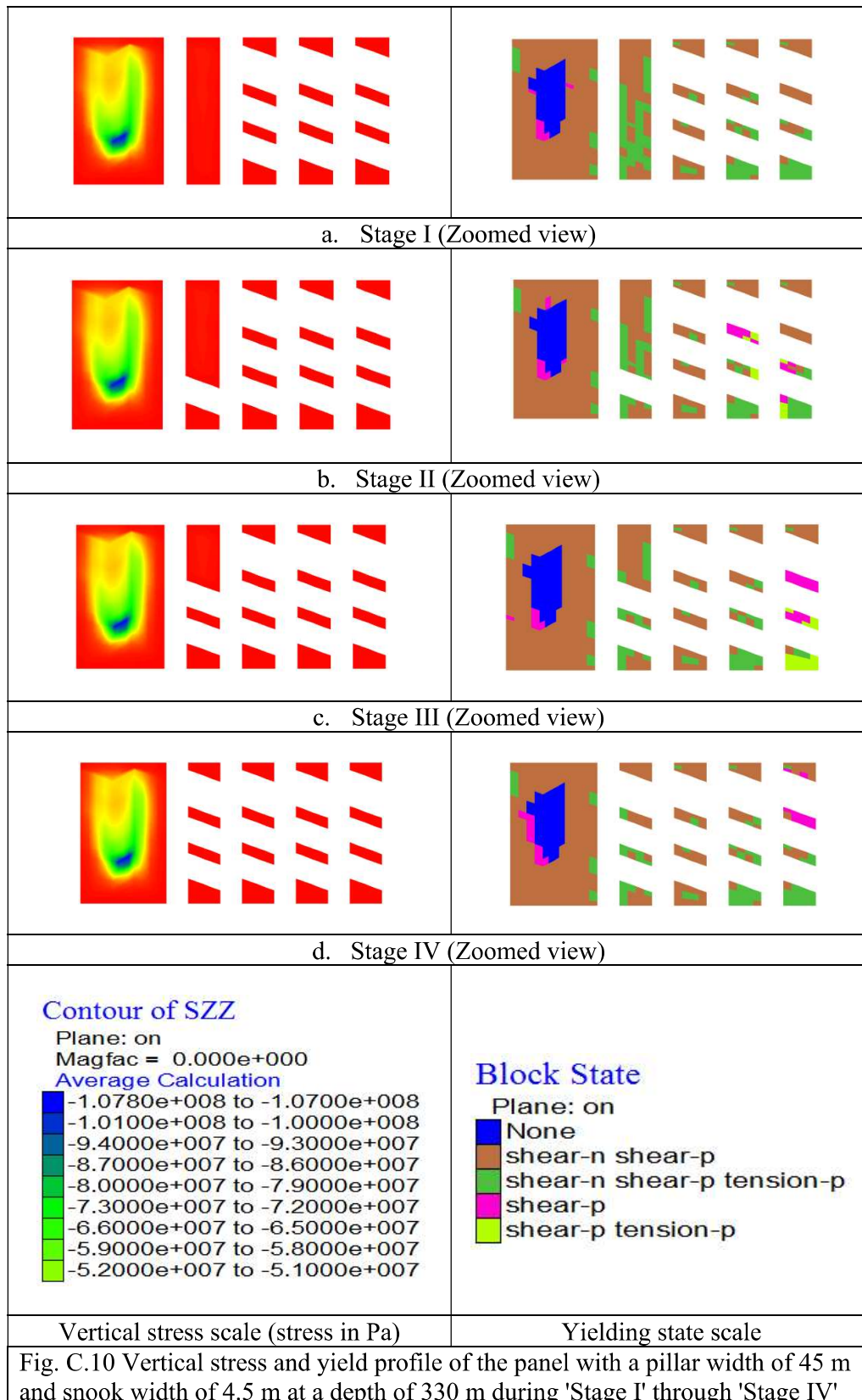


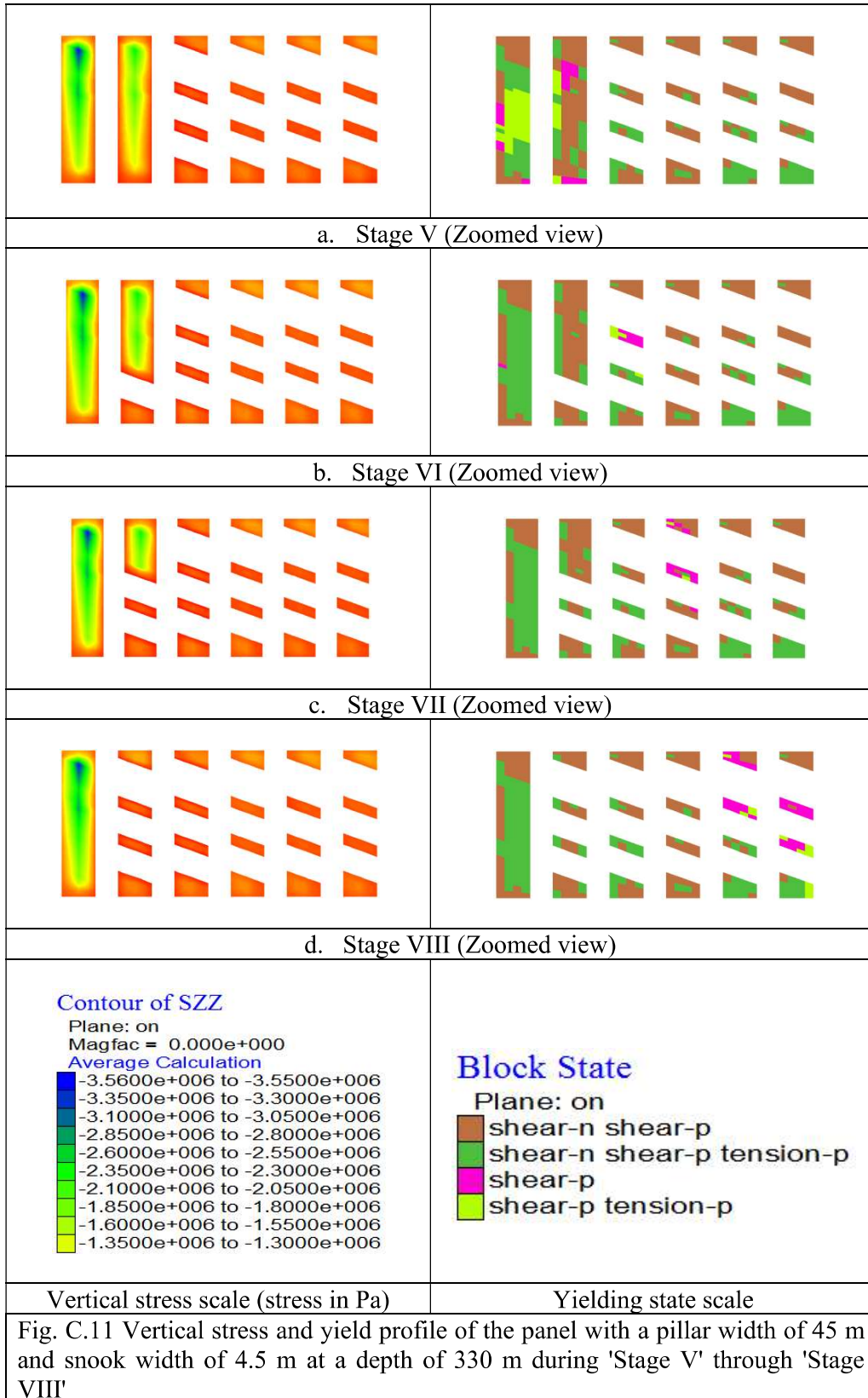


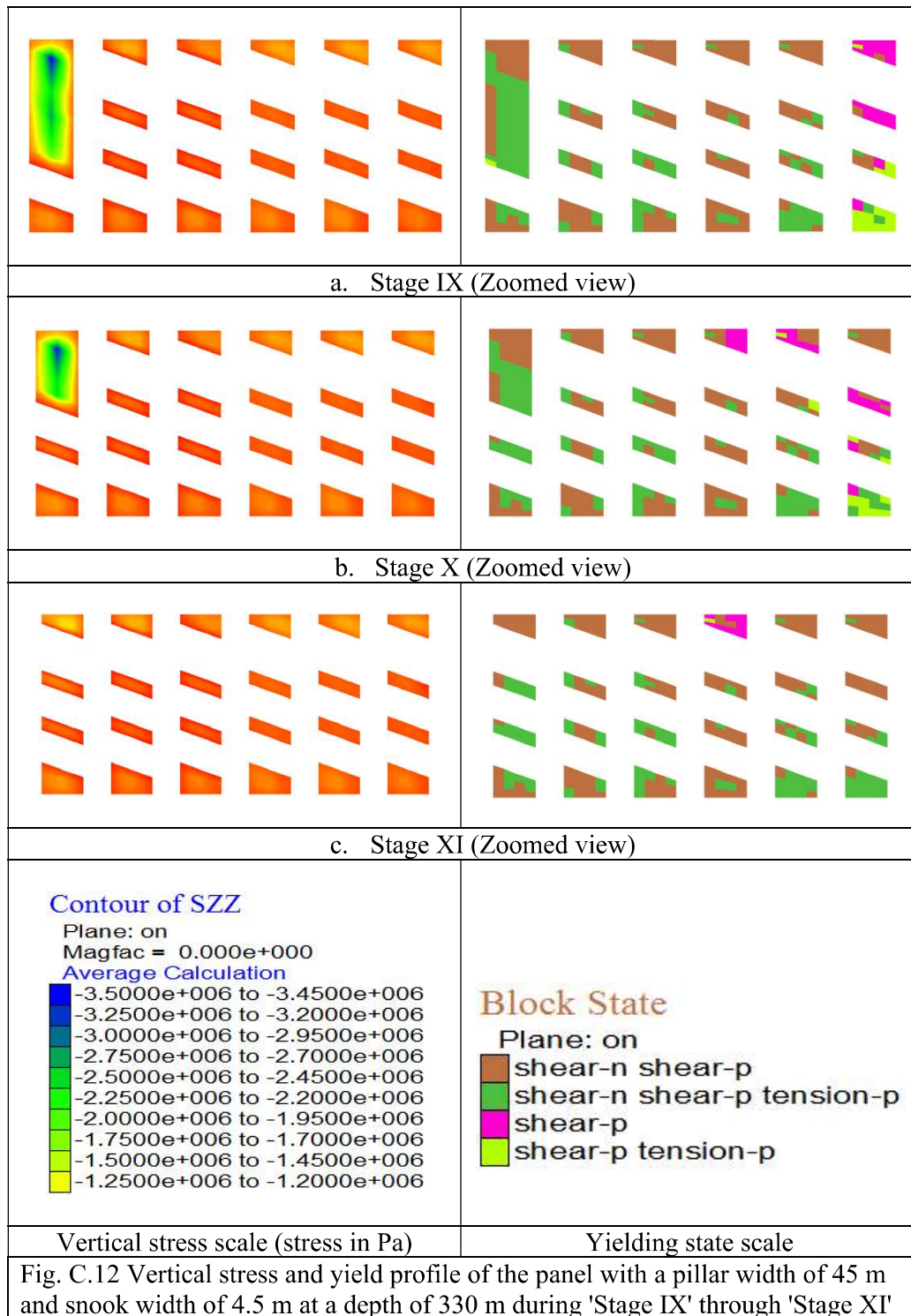
Appendix – C3

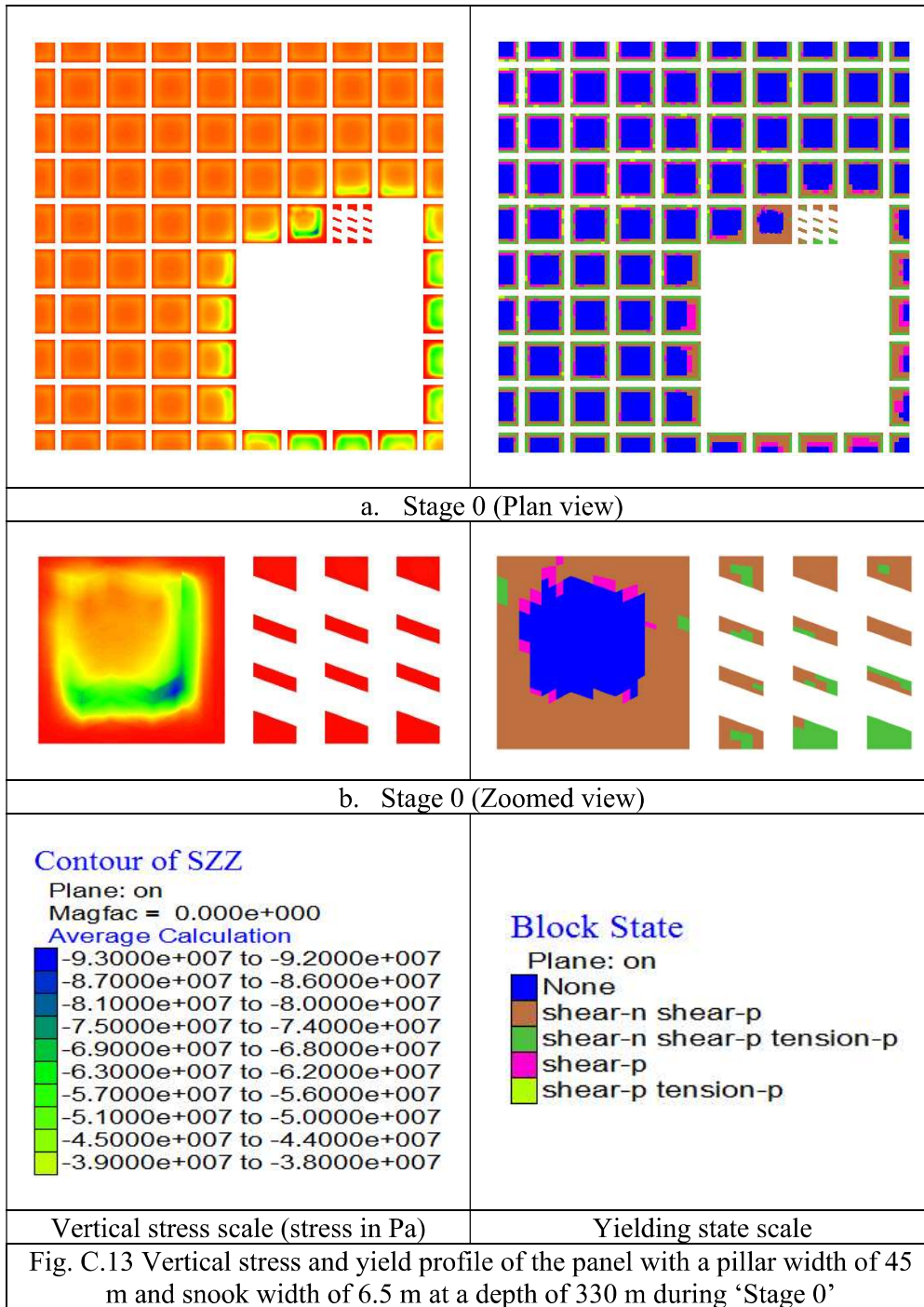
Simulation results concerning remnant pillar for a pillar width of 45 m

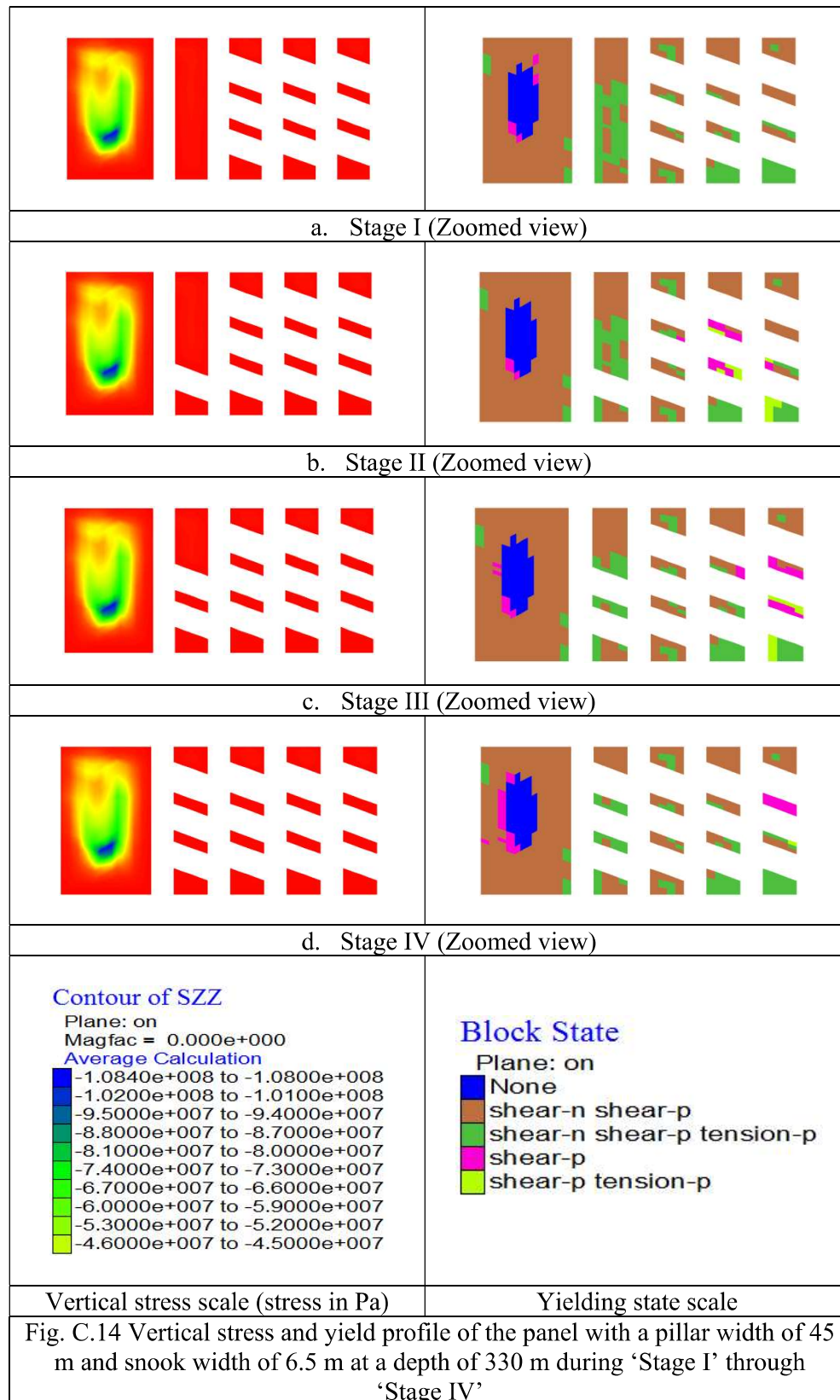


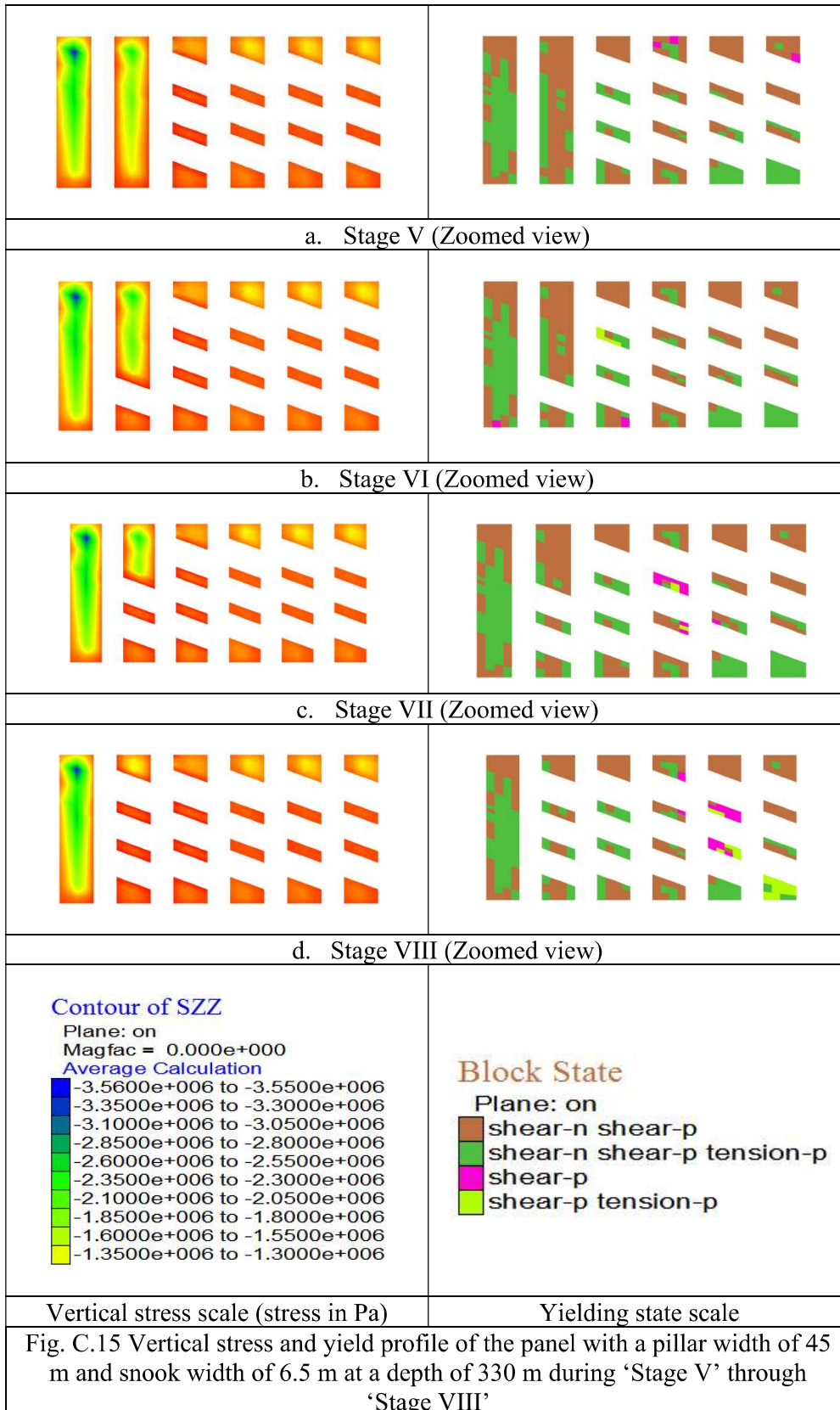


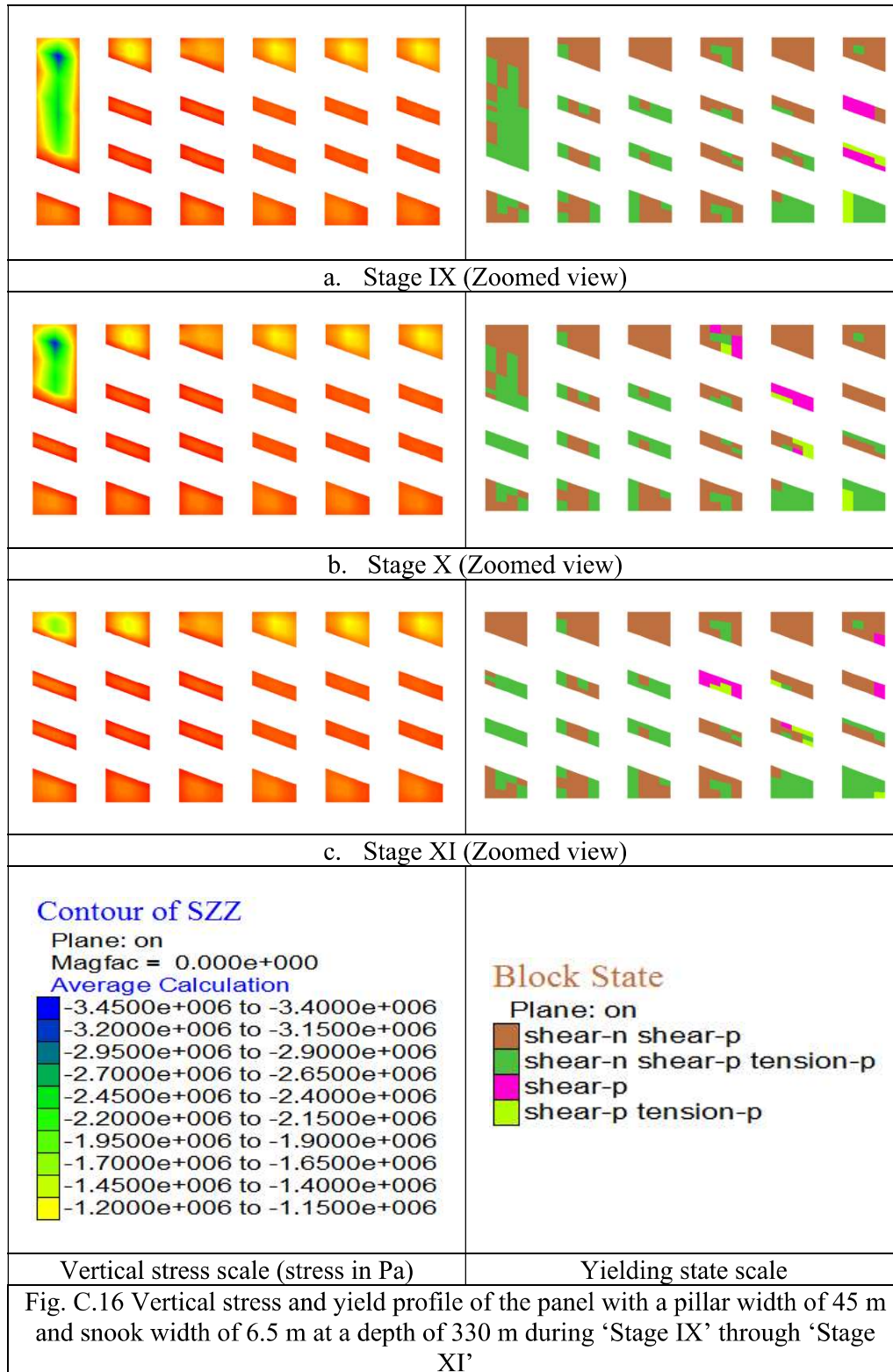












### Appendix – C4

#### Simulation results concerning remnant pillar for a pillar width of 48 m

