Adult Sleep Stage Scoring Rules

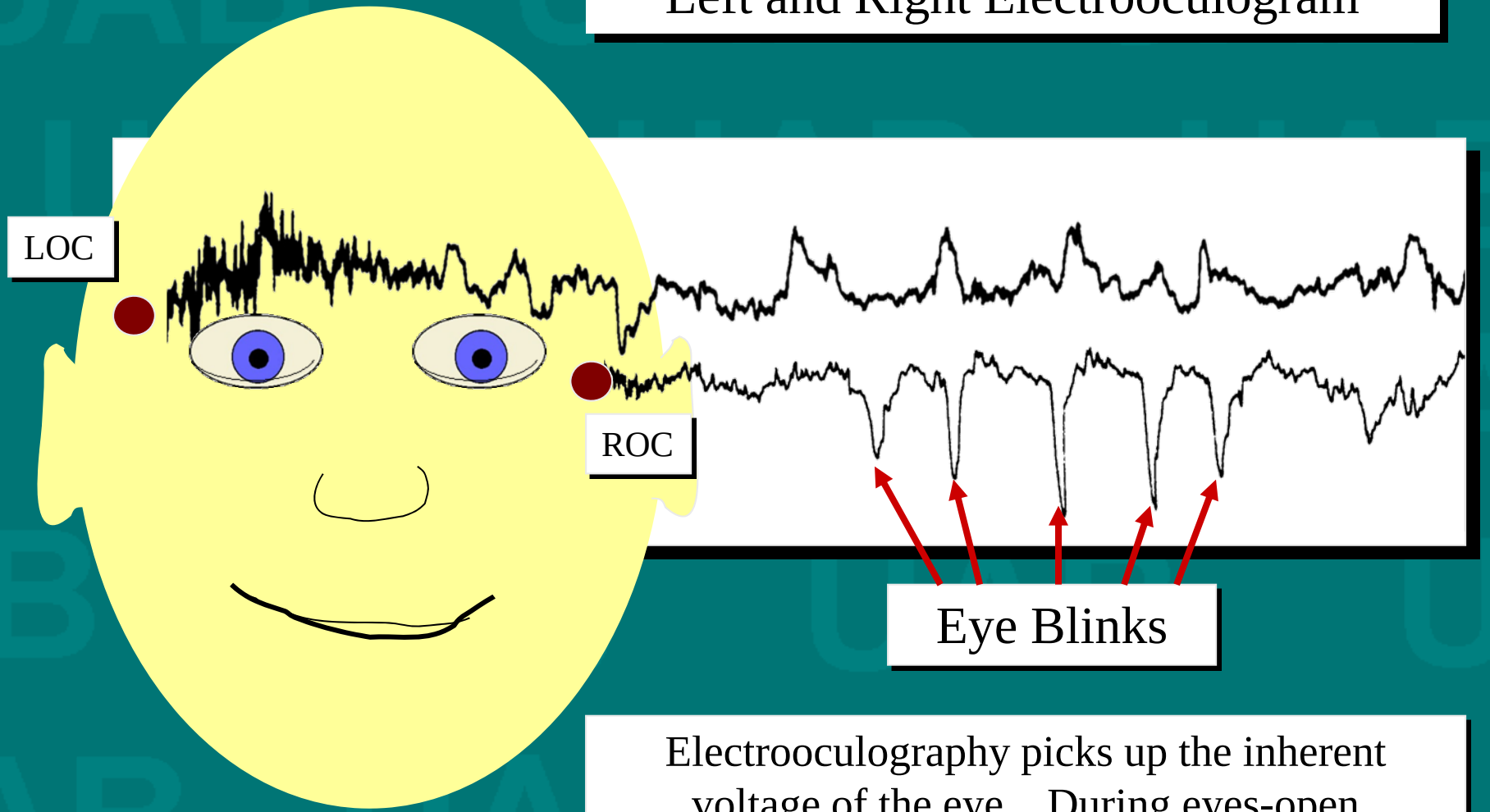
Identification and Staging of Adult Human Sleep

- All recordings in this course have the following montage:
  - EOG (LOC)
  - EOG (ROC)
  - EEG (C3-A2)
  - EEG (O1-A2)
  - EMG (submental)

Parameters for Staging Human Sleep

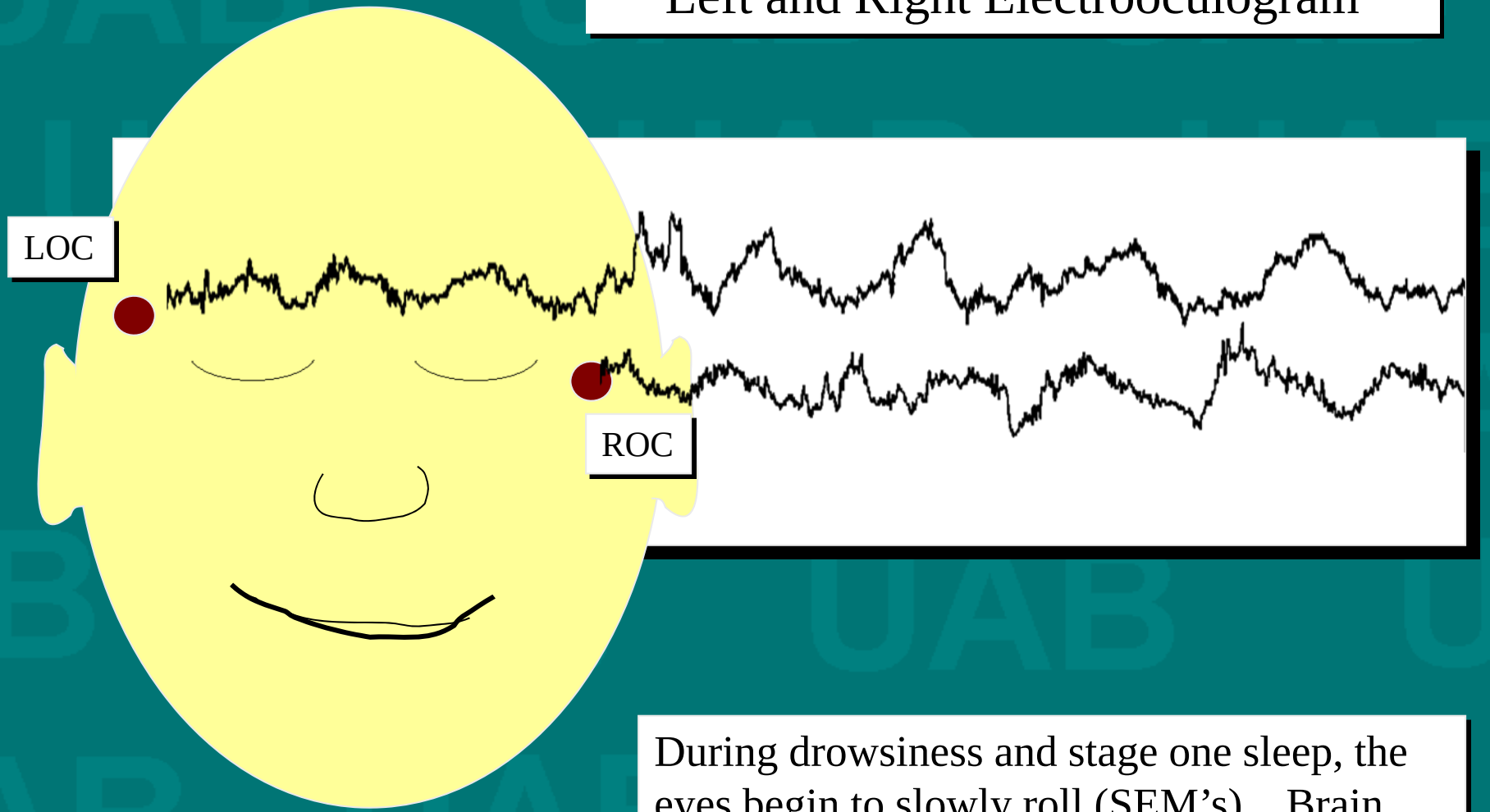
- EOG leads - left eye and right eye
- EEG leads - one central EEG lead and one occipital EEG lead (minimum)
- EMG - one submental EMG channel

Left and Right Electrooculogram



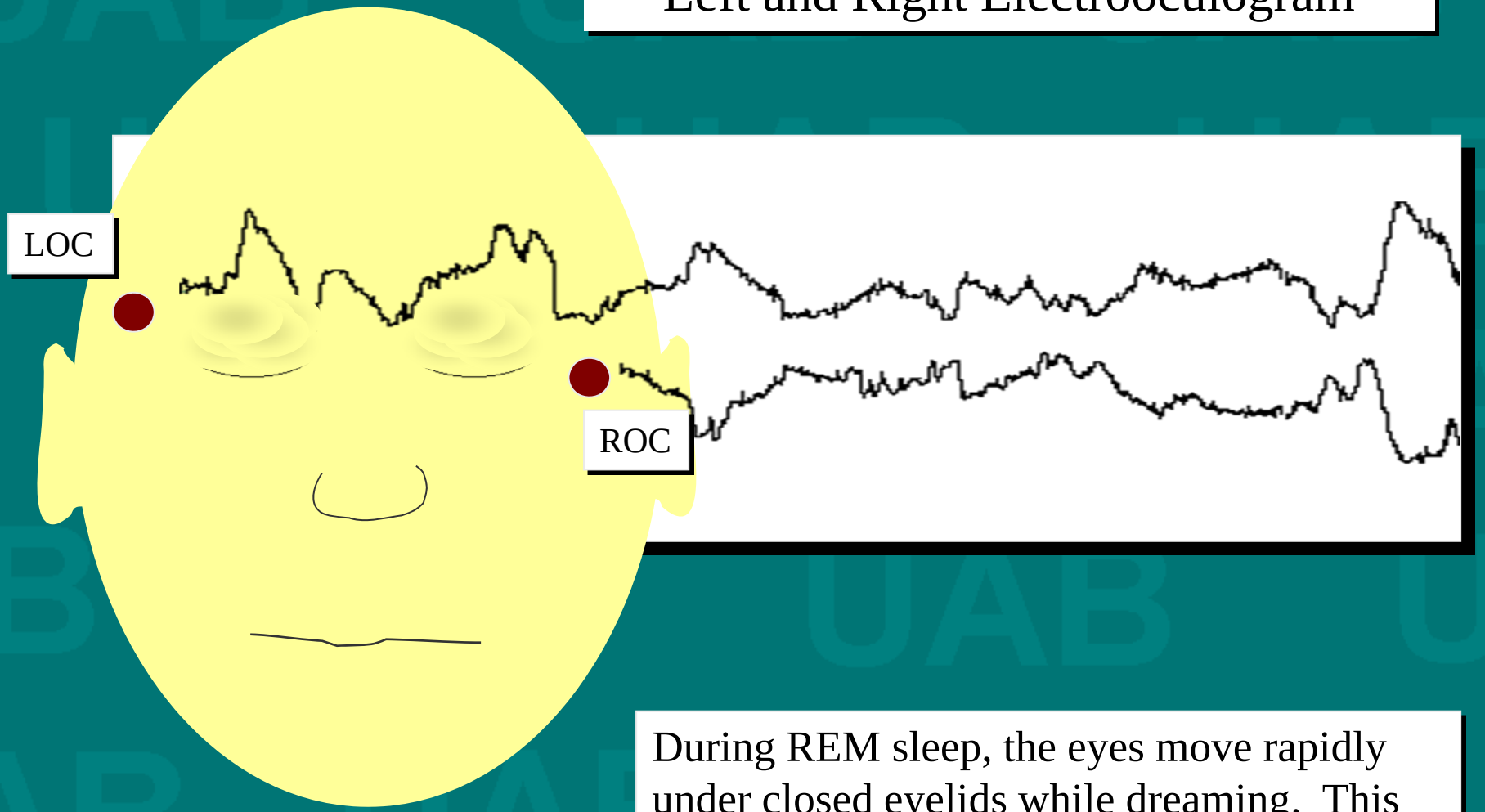
Electrooculography picks up the inherent voltage of the eye. During eyes-open wakefulness, sharp deflections in the EOG tracing may indicate the presence of eye blinks.

Left and Right Electrooculogram



During drowsiness and stage one sleep, the eyes begin to slowly roll (SEM's). Brain wave activity (theta) starts to enter into the EOG tracing as an artifact.

Left and Right Electrooculogram

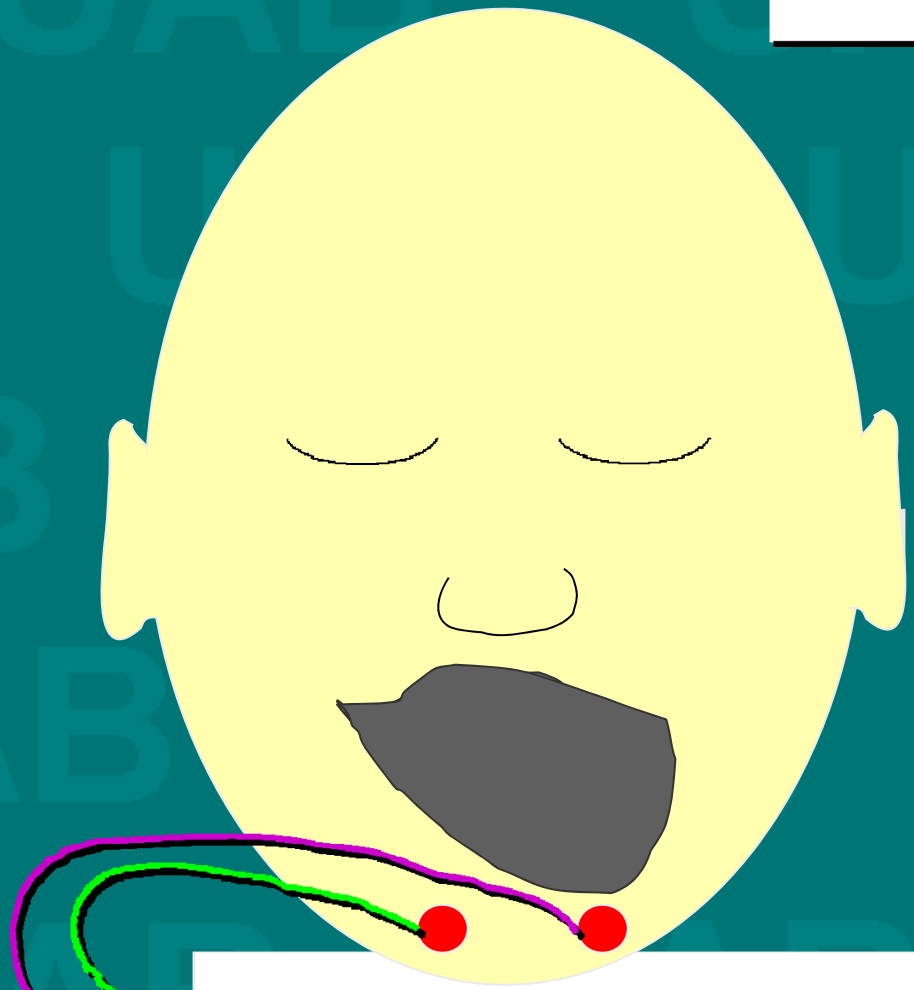


During REM sleep, the eyes move rapidly under closed eyelids while dreaming. This produces rapid conjugate eye movements which appear as out-of-phase EOG channel deflections.

Submental EMG

- Mental, submental, masseter placements are acceptable
- Used to detect muscle tone changes for REM vs. NREM sleep
- Muscle tone high during wakefulness and NREM sleep
- Muscle tone low during stage REM

Mental/Submental EMG



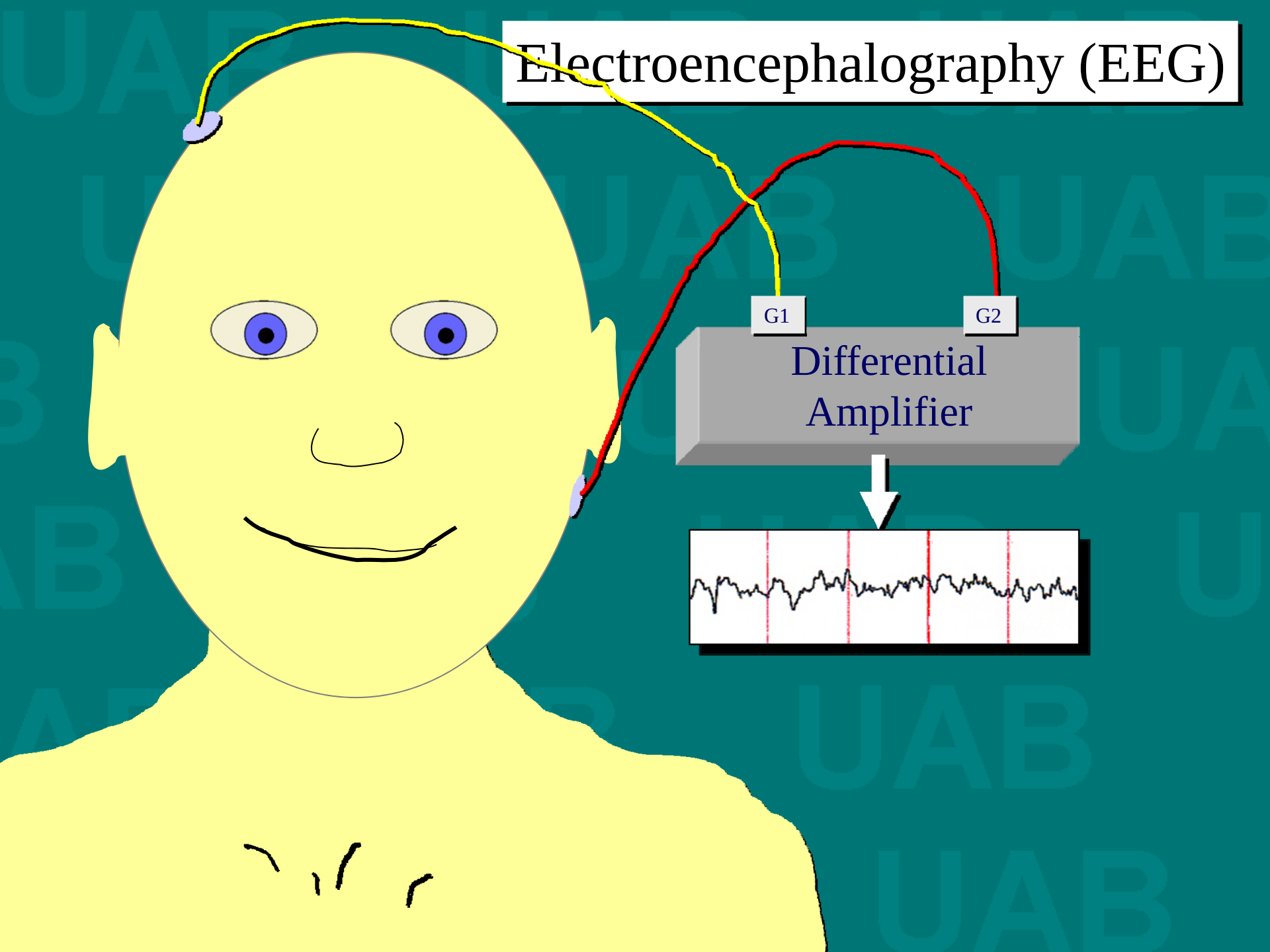
Submental EMG records muscle Tone. This is a mandatory recording parameter parameter for staging sleep (REM vs. NREM). Yawns, swallows, and tooth grinding may also increase muscle tone.

Total duration of yawn causing increased EMG

EEG Recording

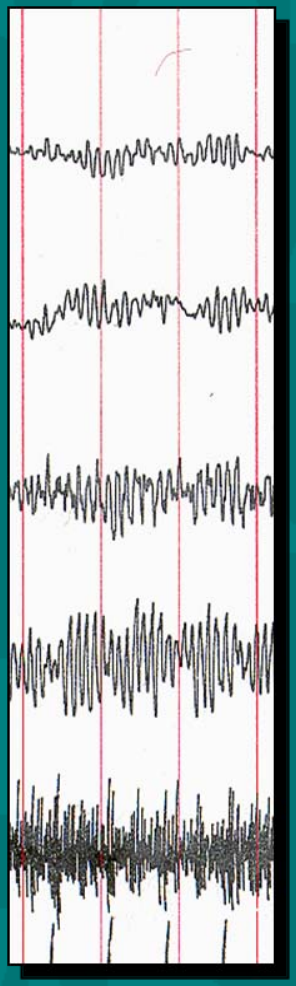
- Minimum paper speed of 10 mm/sec
- TC of .3 (LFF .3 Hz.) minimum
- Pen deflections of 7.5 - 10 mm for 50μv is recommended
- Electrode impedances should not exceed 10KΩ

Electroencephalography (EEG)



Alpha Activity

- Alpha EEG: 8-13 cps.
- Alpha: occipital region
- Alpha: crescendo-decrescendo appearance
- Decrease in frequency occurs with aging

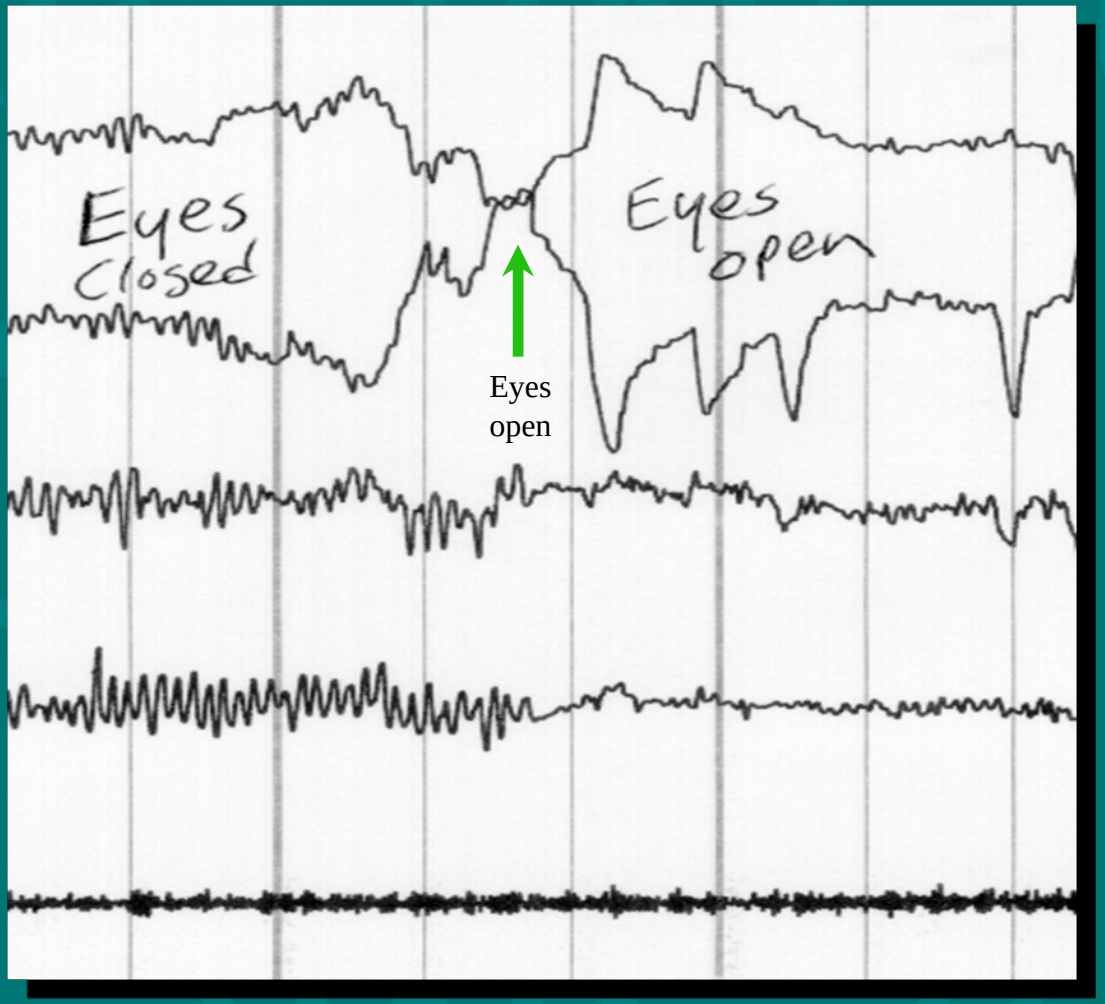


Stage Wake

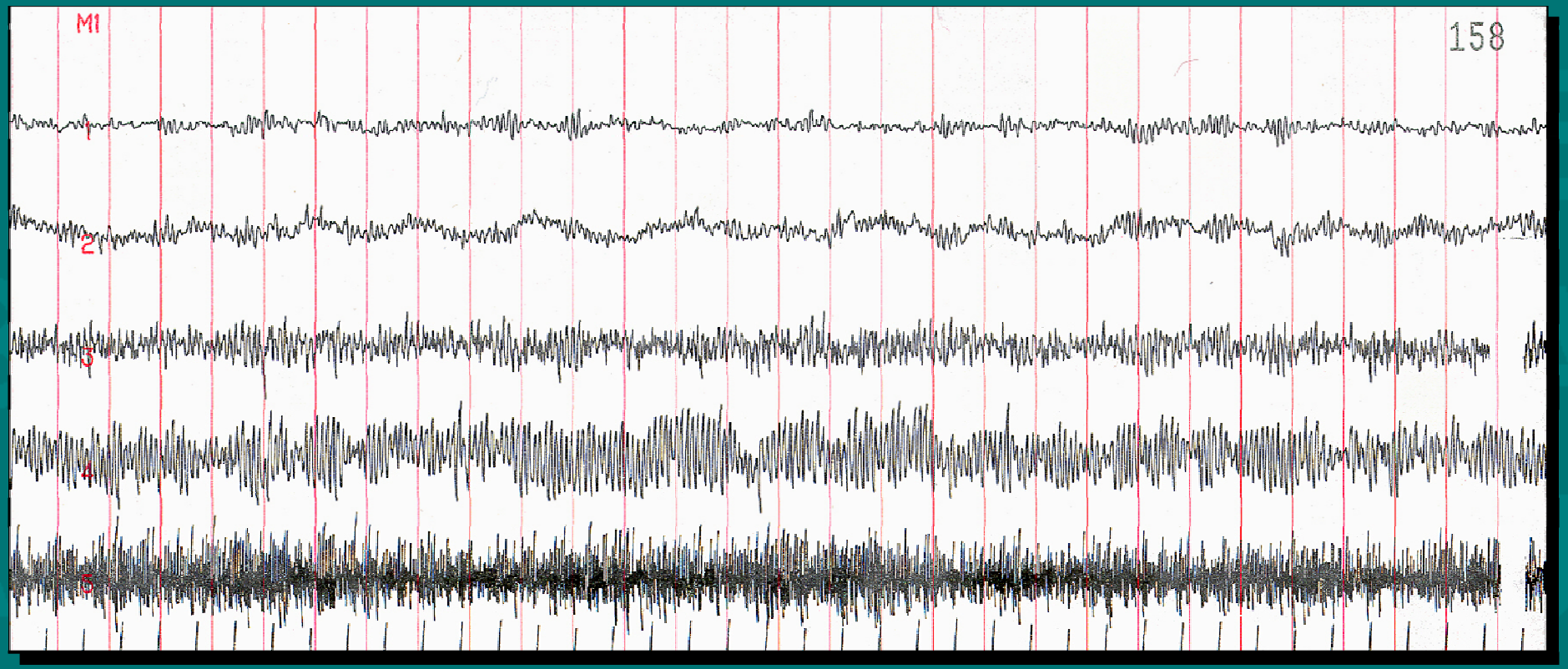
- EOG - Eye blinks OR SEM's
- EEG - >½ epoch has scorable Alpha EEG activity.
- Submental EMG - relatively high tone.

Stage Wake

Eyes Closed vs. Eyes Open



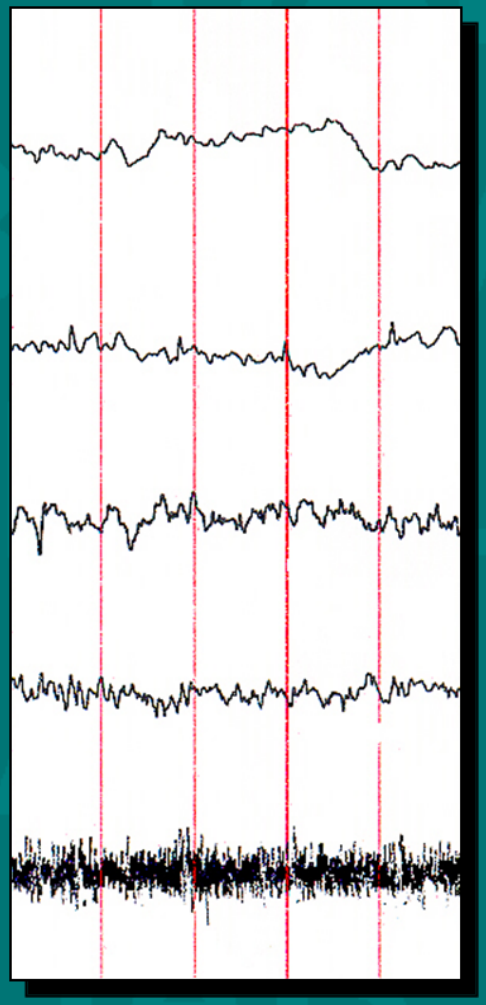
Stage Wake



- >50% of each epoch contains alpha activity.
- Slow rolling eye movements or eye blinks will be seen in the EOG channels
- Relatively high submental EMG muscle tone

Theta Activity

- A frequency of 3-7 cps.
- Produced in the central vertex region
- No amplitude criteria for Theta
- The most common sleep frequency



Stage One Sleep

- Scored when >15 seconds of theta is seen, replacing an Alpha.
- Considered a transitional sleep stage
- Very short duration
- “Church Sleep”, or “Car Driving Sleep”.

Stage One Sleep

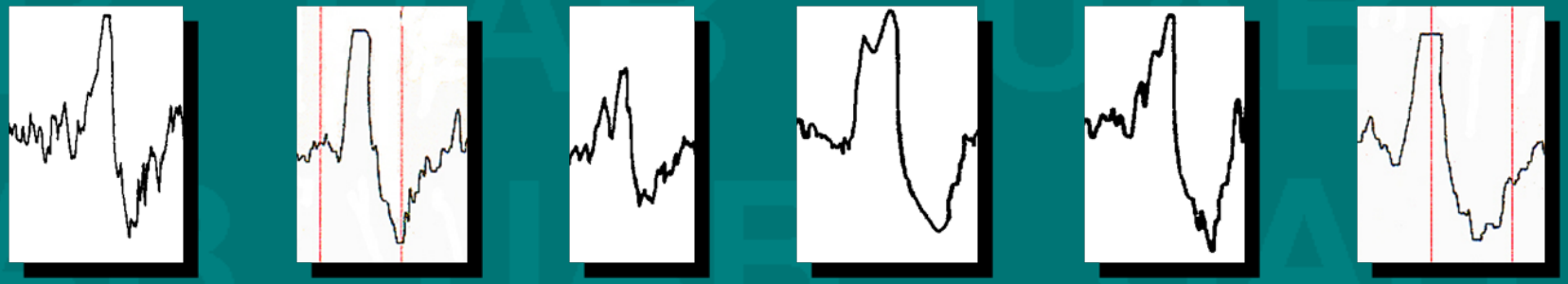
- ≥ 50% of the epoch contains theta activity (3-7 cps.) There may be alpha activity within <50% of the epoch.
- Slow rolling eye movements in the EOG channels
- Relatively high submental EMG tone.

Sleep Spindles

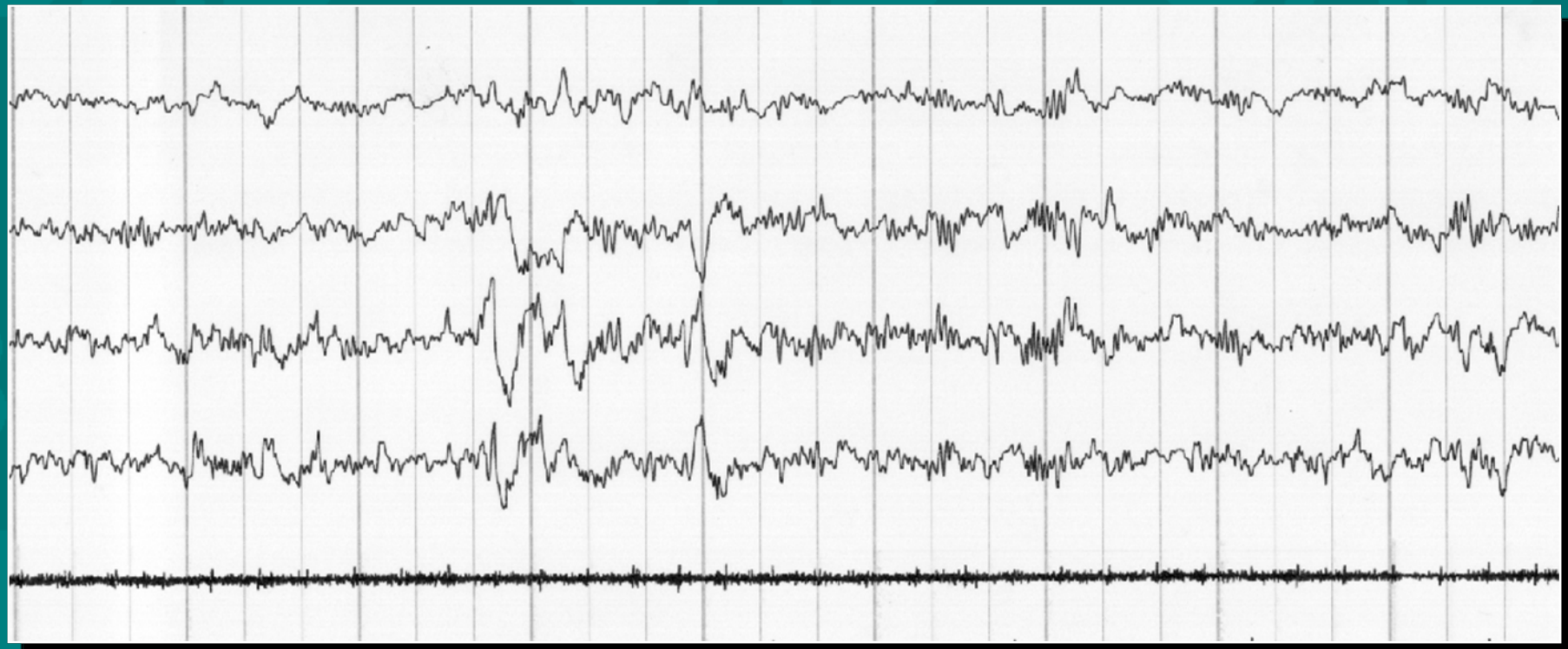
- Sleep Spindle - 12-14 cps.
- Central - vertex region
- ≥.5 to 2-3 seconds in duration
- .5 second spindles - 6-7 cycles
- Indicative of stage 2 sleep

K Complexes

- Sharp, slow waves, with a negative then positive deflection
- No amplitude criteria
- Duration must be at least .5 seconds
- Predominantly central-vertex in origin
- Indicative of stage 2 sleep
- They may occur with stimuli or without stimuli.



Stage Two Sleep



- Background EEG is Theta (3-7 cps.)
- K-Complexes and Spindles occur episodically
- Mirrored EEG in the EOG leads
- Low tonic submental EMG

Stage Two Sleep

- Excessive spindles may indicate the presence of some medications (benzodiazepines)
- Normal variant for scoring human sleep

Stage Two (Typical look)

- Stage 2 sleep with low K complex quantity and high amplitude spindles.
- Normal variant

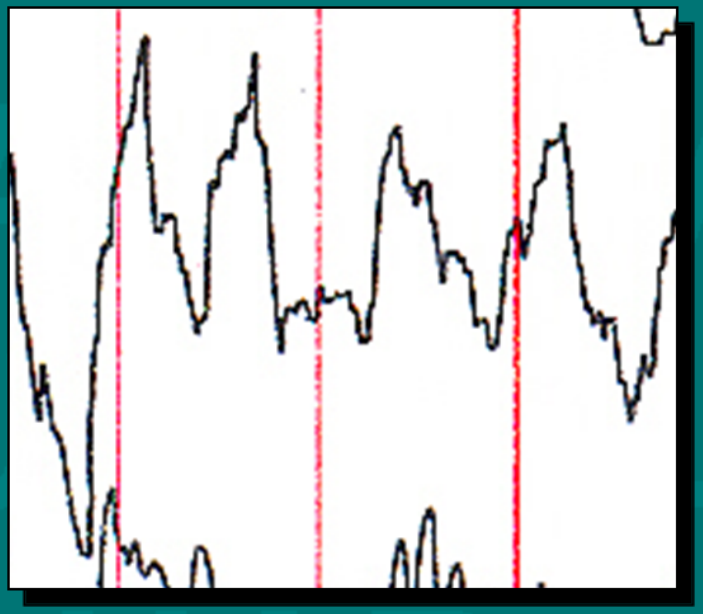
Stage Two Sleep

Three Minute Rule

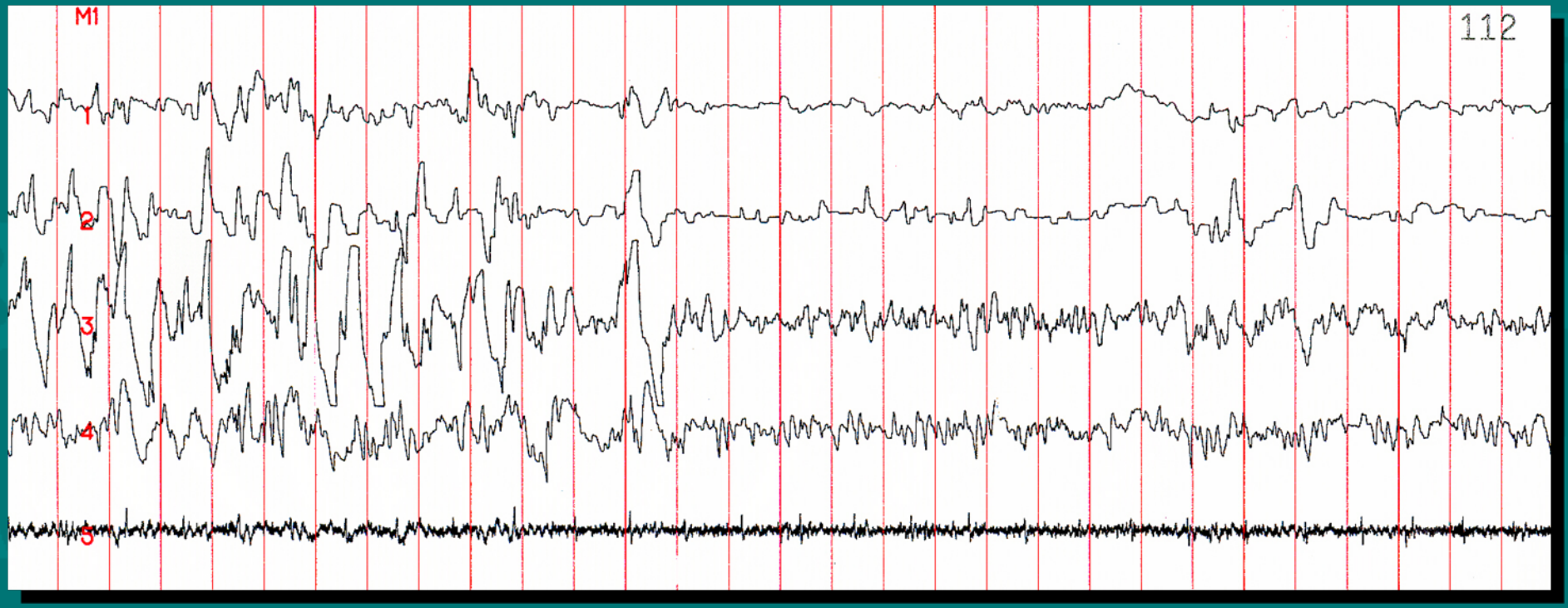
- If a K complex or spindle is not seen within three minutes of the previous K or spindle, the scoring will default to stage one (1) sleep.

Delta Activity

- Sleep Delta Activity - frequency of .5-2 cps.
- Clinical EEG - frequency of ≥ .5-4 cps.
- Seen predominantly in the frontal region
- Delta Activity - amplitude of ≥ 75μv

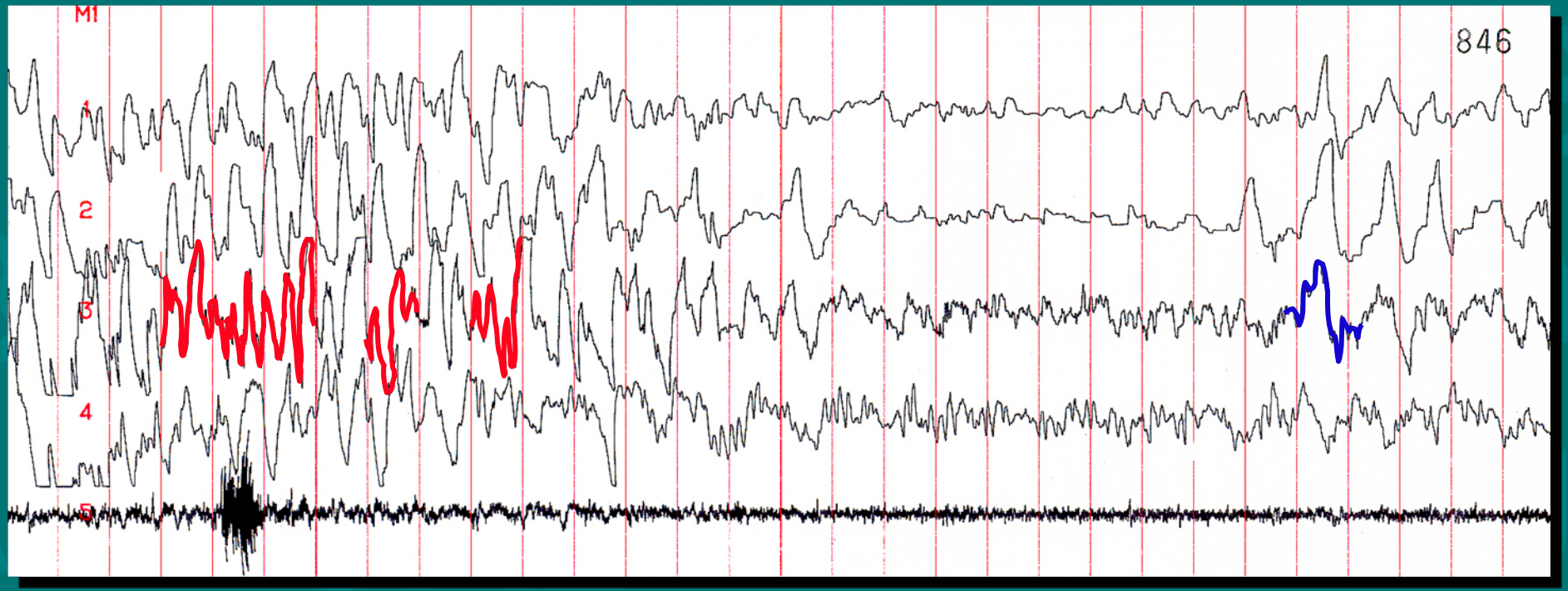


Stage Three Sleep



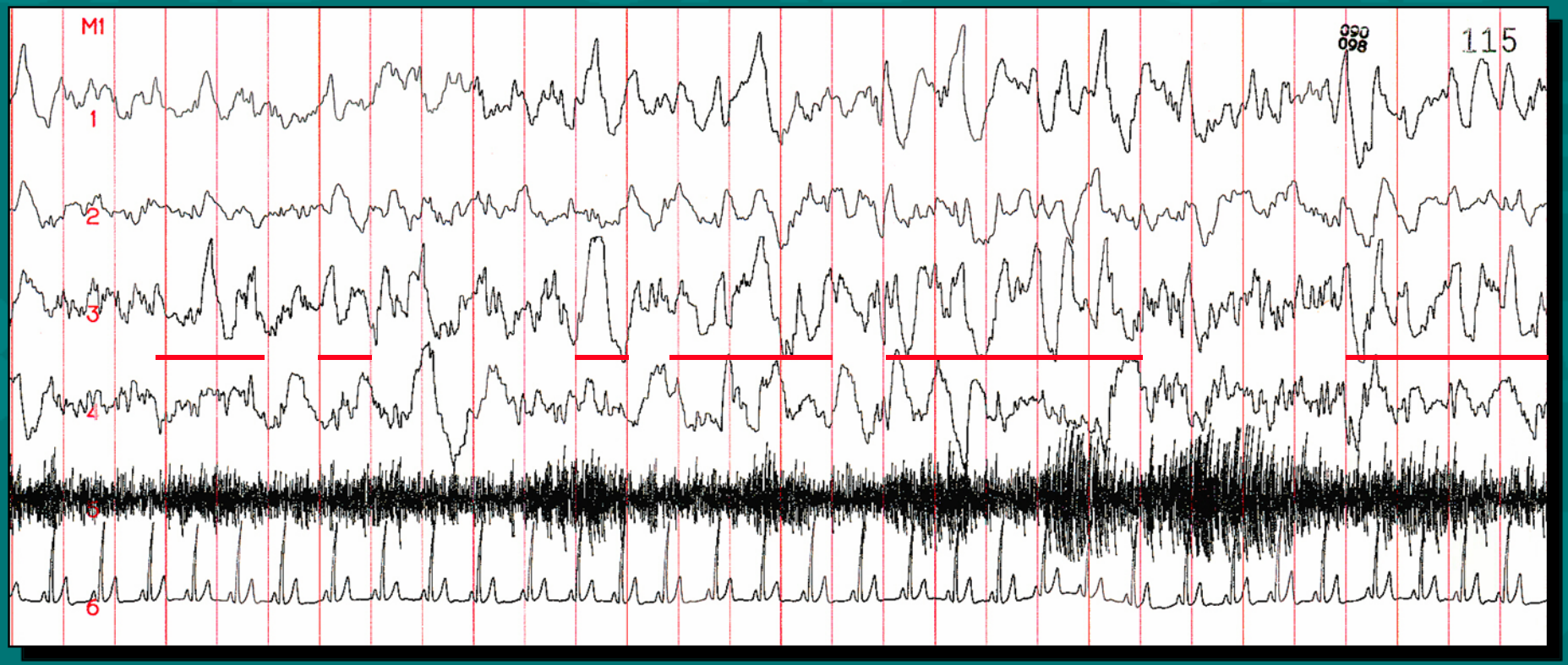
- 20% to 50% Delta Activity is seen.
- EOG leads will only pick up the EEG activity.
- EMG may be slightly lower than that of Stage two.

Stage Three vs. Stage Four



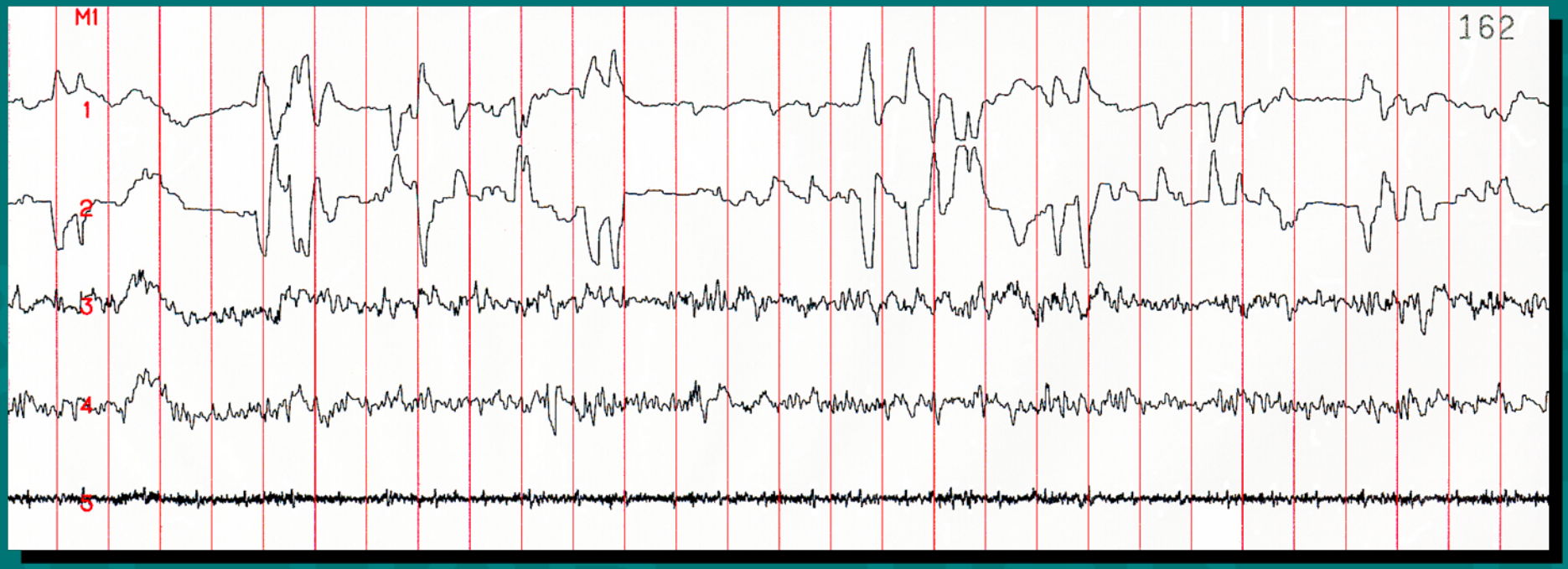
- Stage three or four?
- Frequencies >2cps. Must be eliminated from consideration.
- K Complexes must be eliminated from delta counts.

Stage Four Sleep



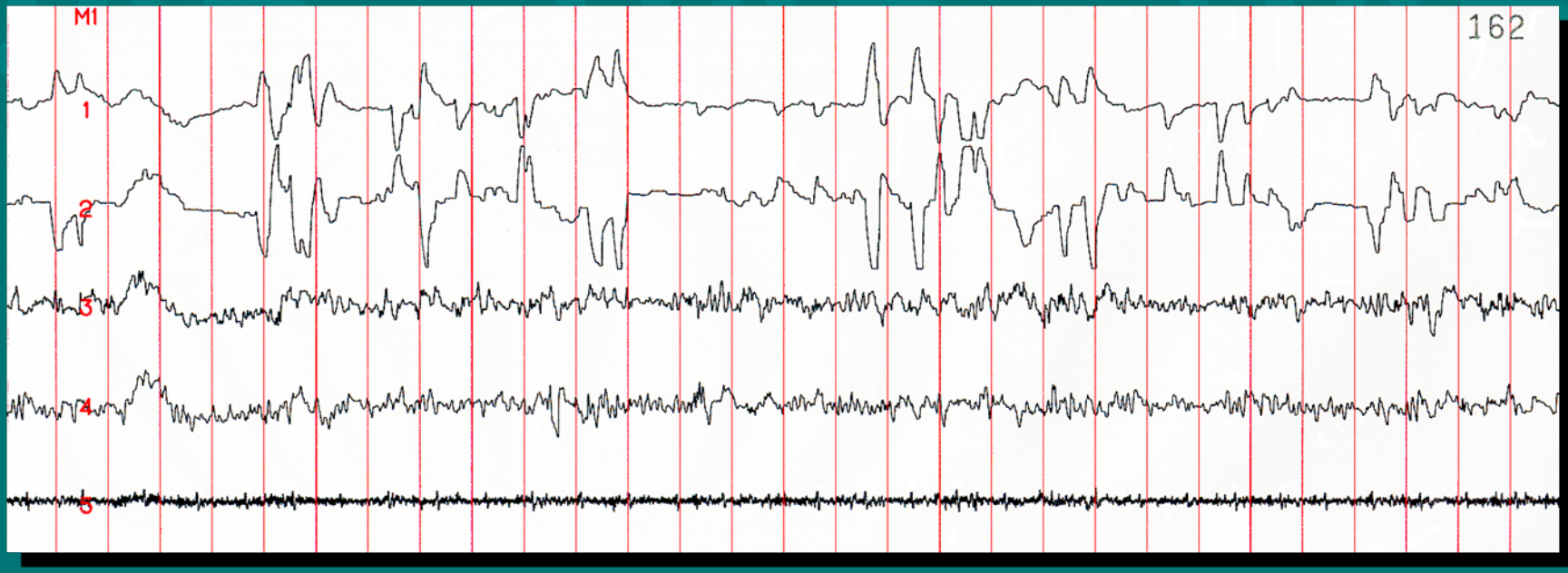
- >50% Delta Activity in the EEG Leads.
- EOG is only recording frontal EEG activity.
- EMG is at the same level as Stage Three sleep.

Stage REM Sleep



- Mixed frequency EEG. Alpha may be seen; usually 1-2 cps. slower than waking
- REM's are seen in the EOG leads.
- Low submental EMG
- Any two of the previous three criteria must be present to score REM Sleep.

Phasic REM



Tonic REM

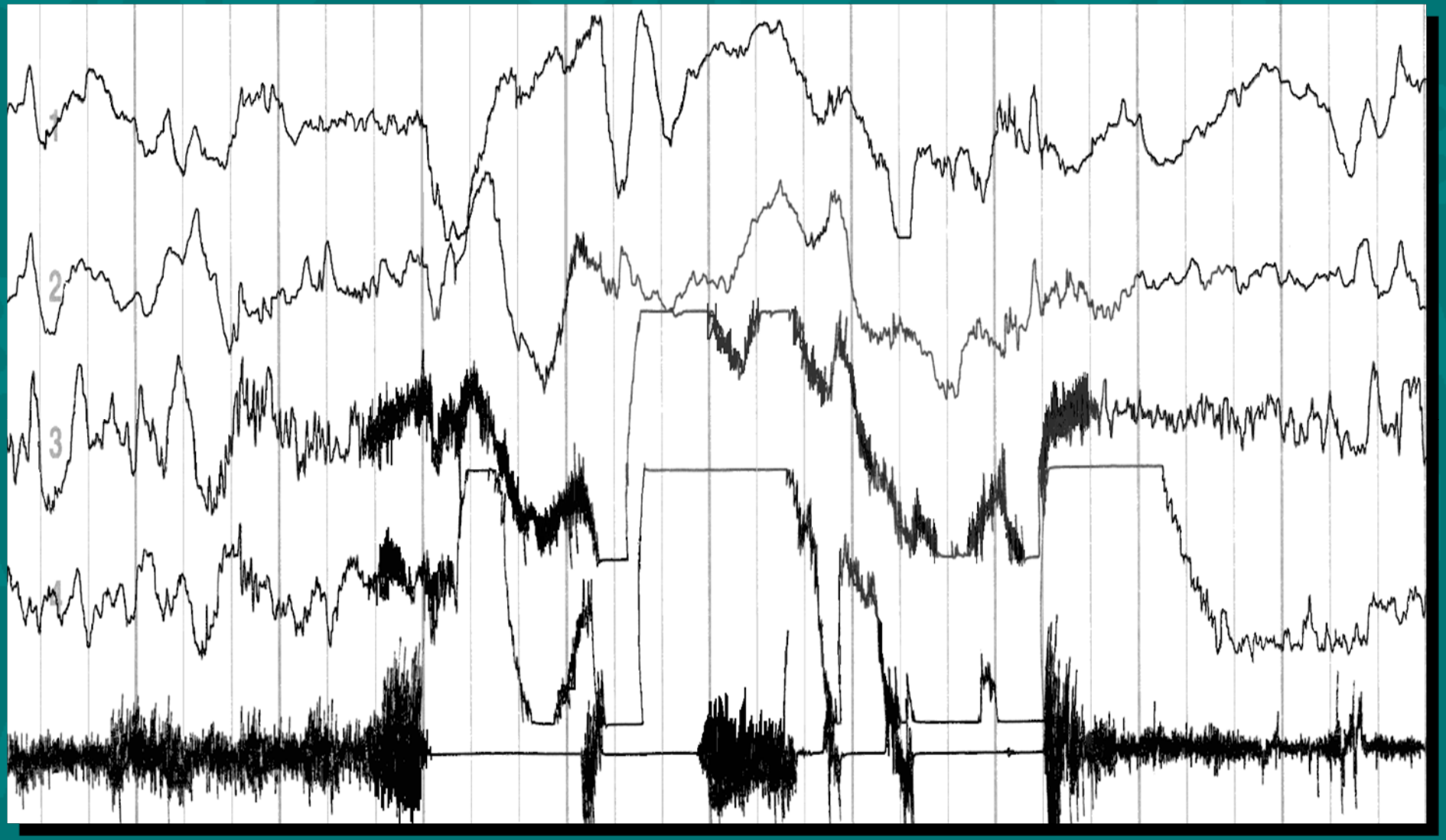
REM With K Complexes or Spindles

- K Complexes and/or spindles may occur while in stage REM.
- Each K or Spindle must be separated by phasic REM activity.
- While in stage REM, > 3 minute separation periods between K complexes or spindles without REM's is scored as stage 2.
- To maintain REM sleep, K's or spindles must be separated by phasic REM

Movement Time

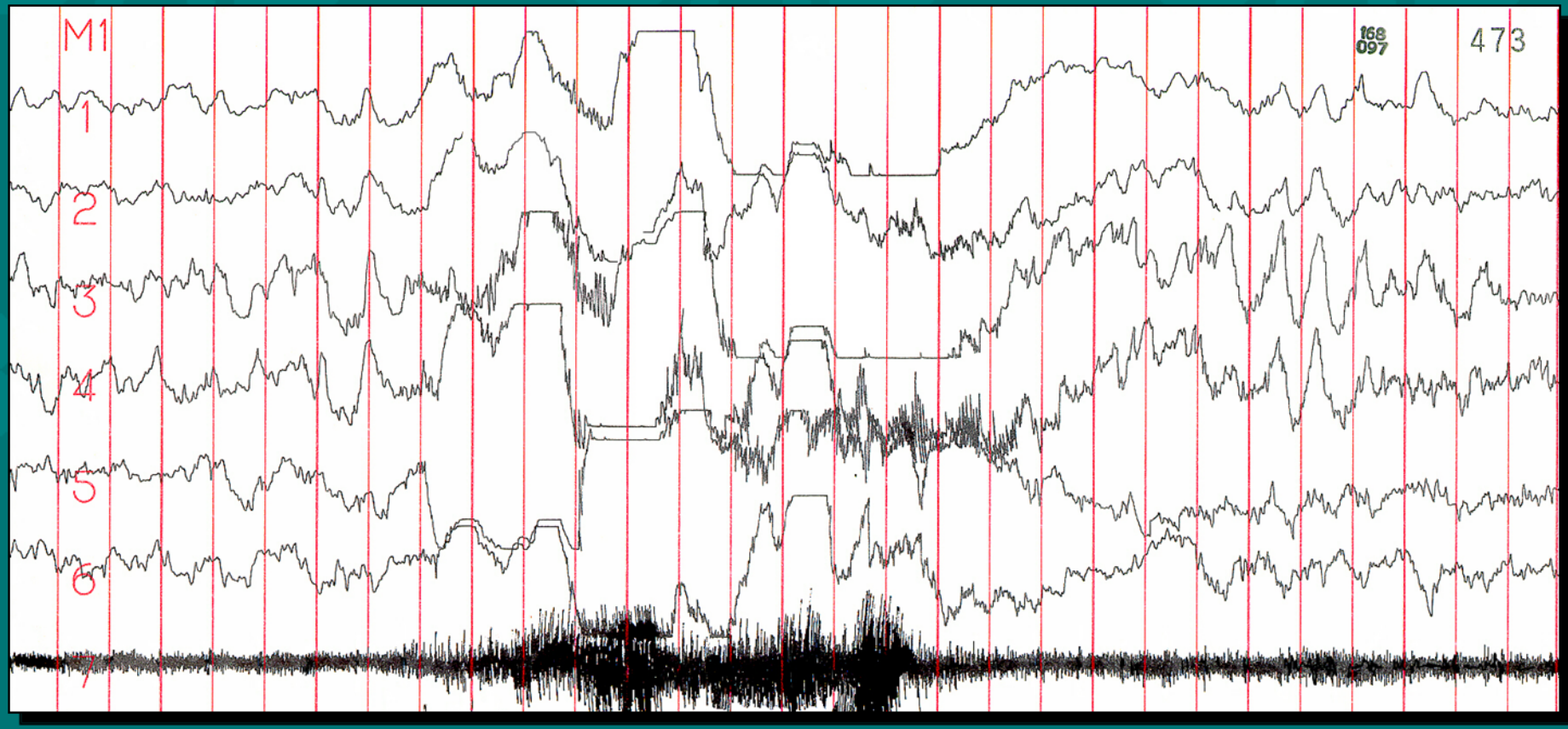
- Amplifier blocking or excessive EMG
- Obscured tracing
- Sleep must occur before and after
- $\geq$ 15 seconds $\leq$ than one minute
- Scorable stage of sleep

Movement Time

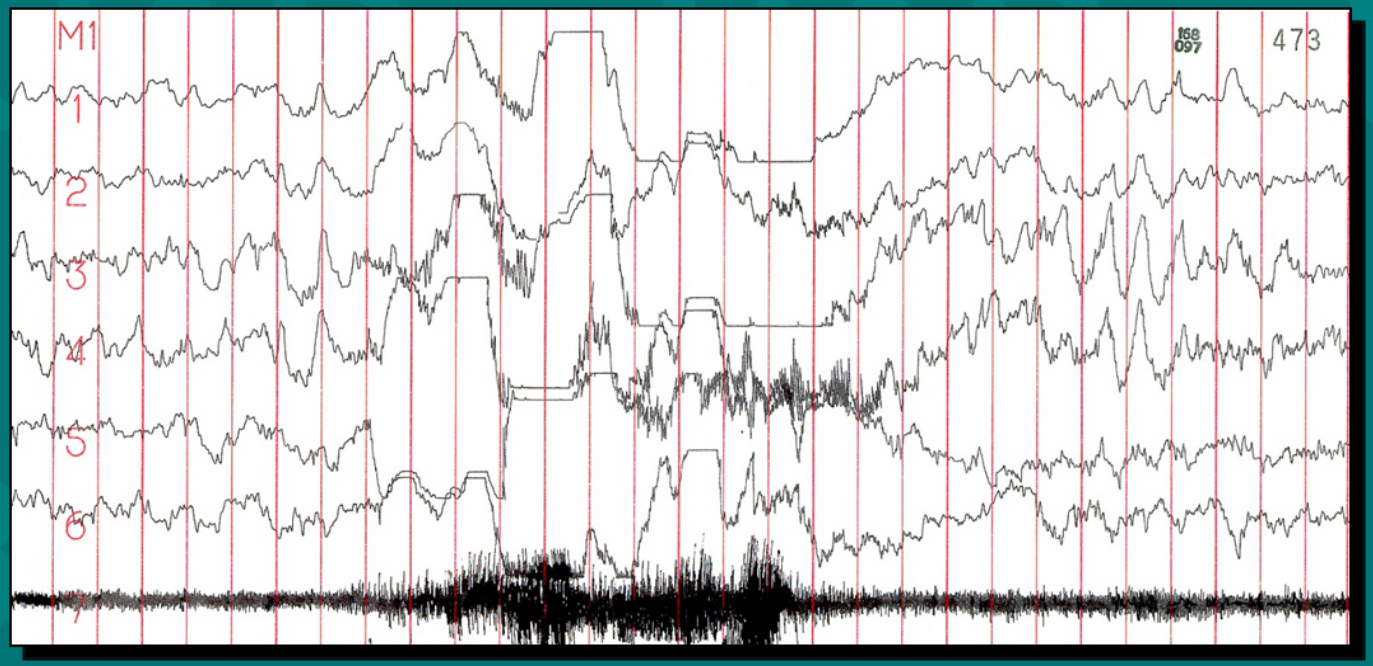


- Amplifier blocking, excessive muscle activity, and obscurity of the EEG make up the scoring criteria for REM sleep.

Random Body Movements and/or EEG Arousals

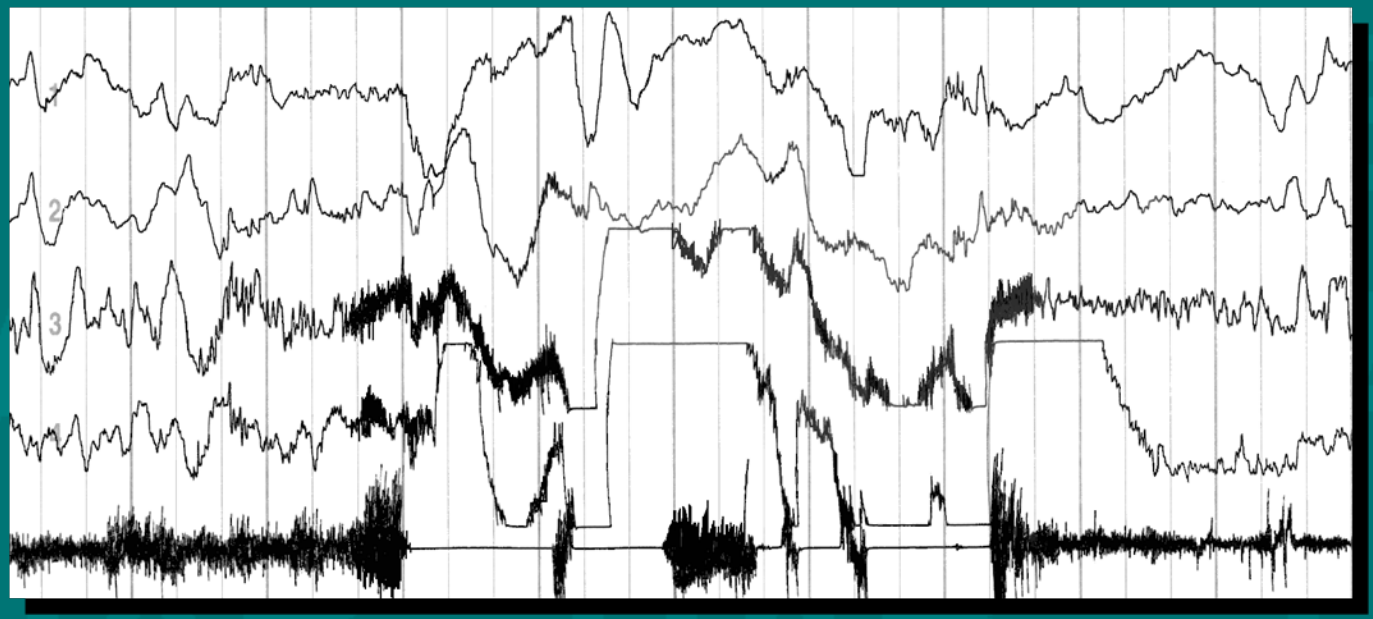


- < 15 seconds in total duration
- ≥ 3 seconds but < 15 seconds of EEG shift to faster frequency
- Sleep is maintained



EEG Arousal

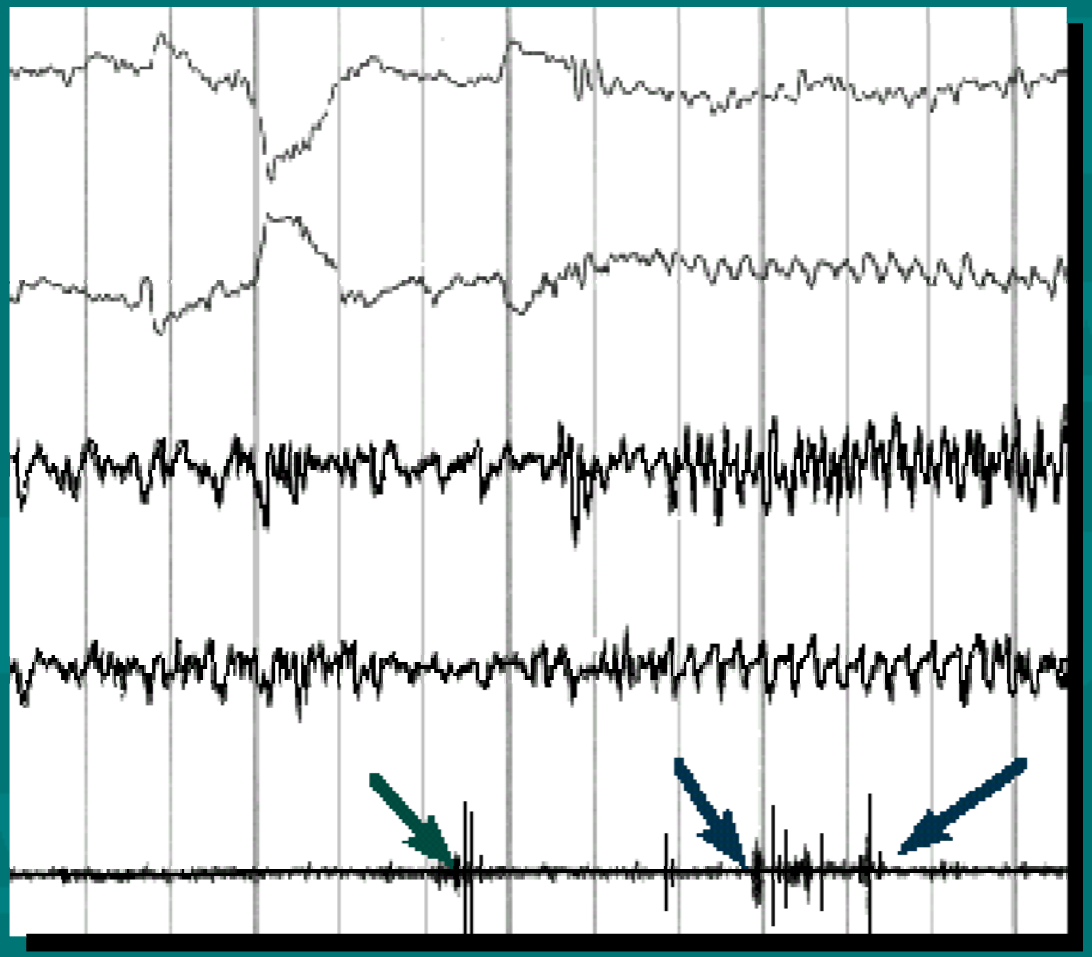
Very short duration (< 15 seconds) activity with no EEG obscuring



MVT Time

Over 15 seconds of amplifier blocking, etc., that obscures record

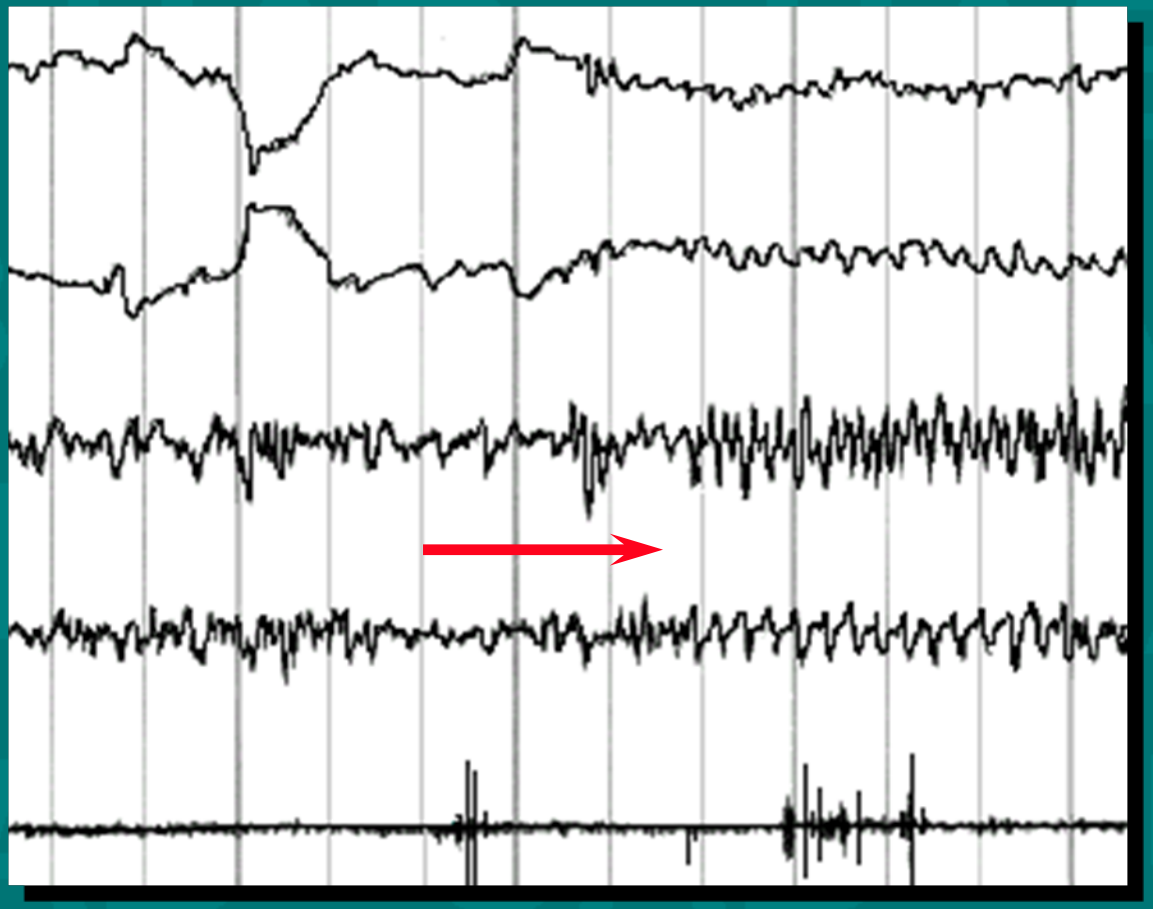
Stage REM: Phasic Twitching



The arrows are pointing to Phasic Twitching

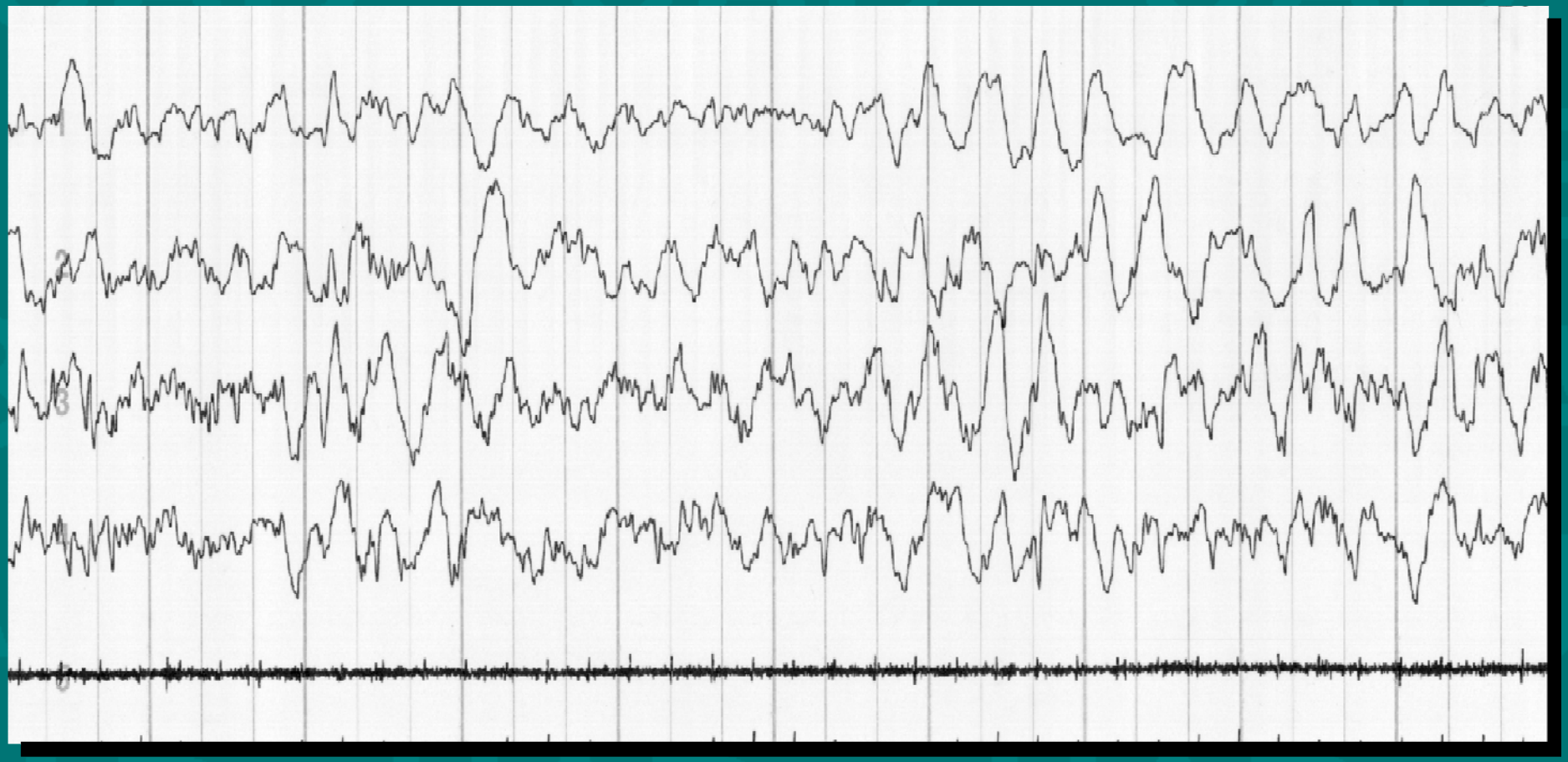
- Very short muscle twitches that normally occur in REM Sleep.
- May occur in the inner ear, genioglossal, limb, and facial muscles
- Another form of phasic activity is Penile Tumescence.

Sawtooth Pattern



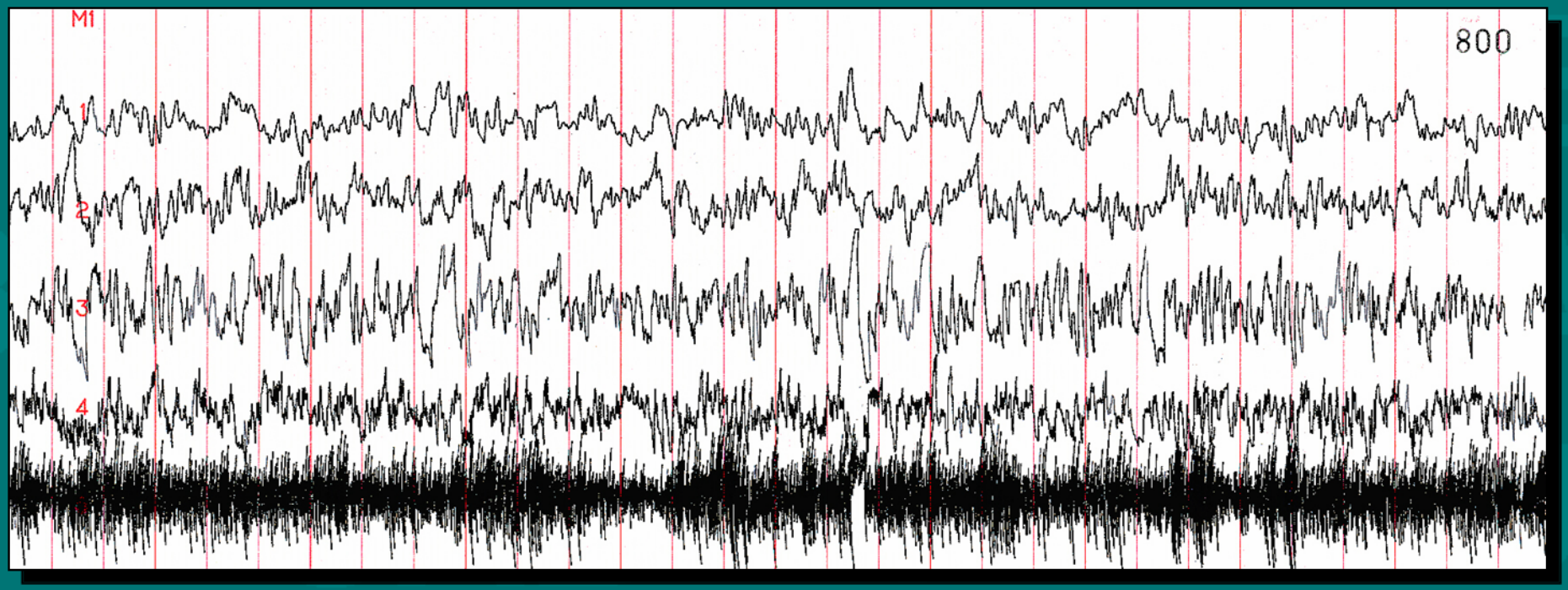
- Jagged evenly formed EEG pattern seen usually in the vertex region
- Seen predominantly in REM

Alpha Delta Sleep (non-restorative sleep)



- Alpha frequencies intrude into Delta Sleep.
- Usually 2-3 cps. slower than waking alpha
- Fibromyalgia or other muscular / joint pain disorders.

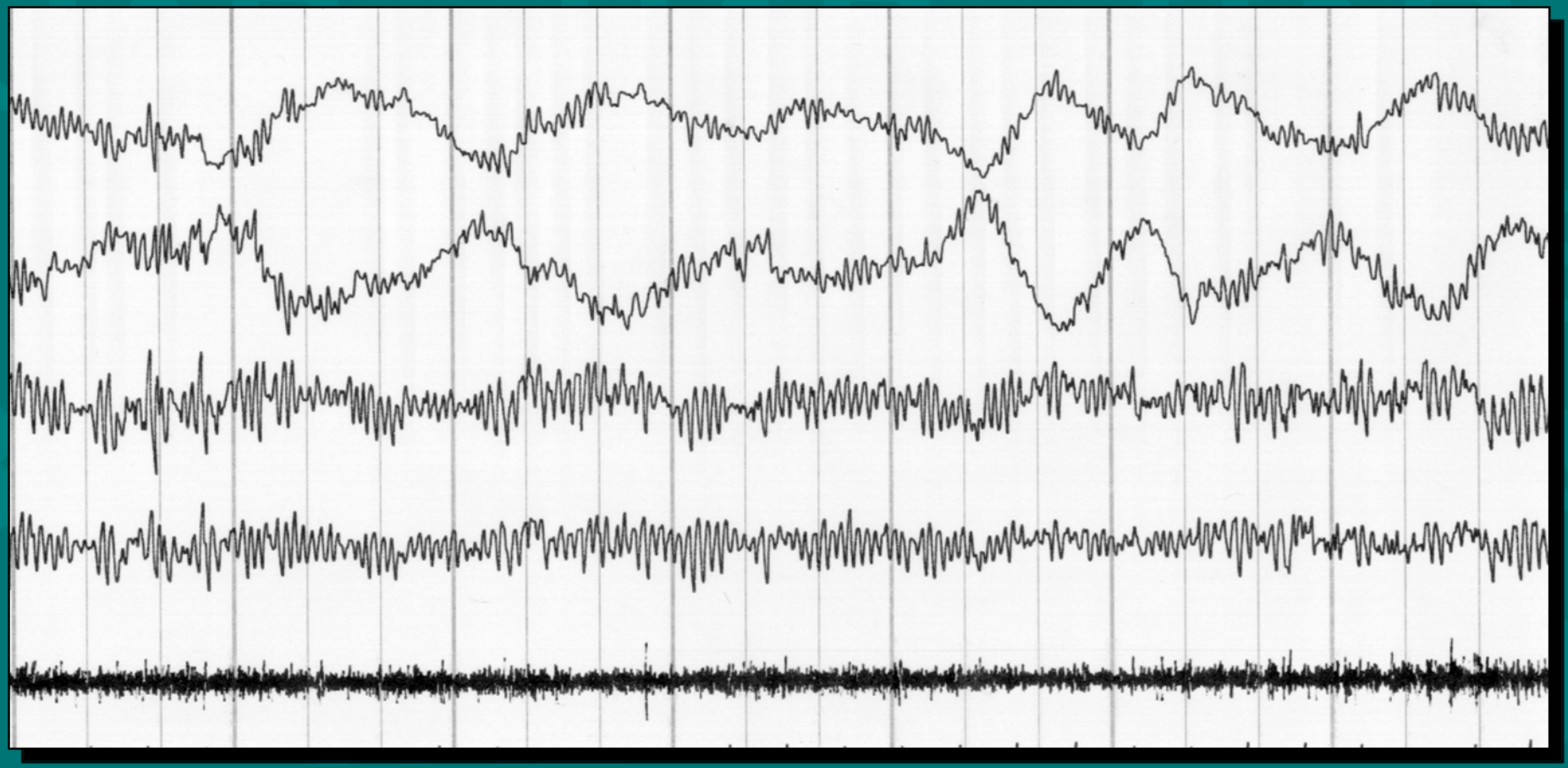
Non-Restorative Sleep



- Significant alpha intrusion
- Alpha frequencies within 2-3 cps. of waking alpha range

Self Test Section

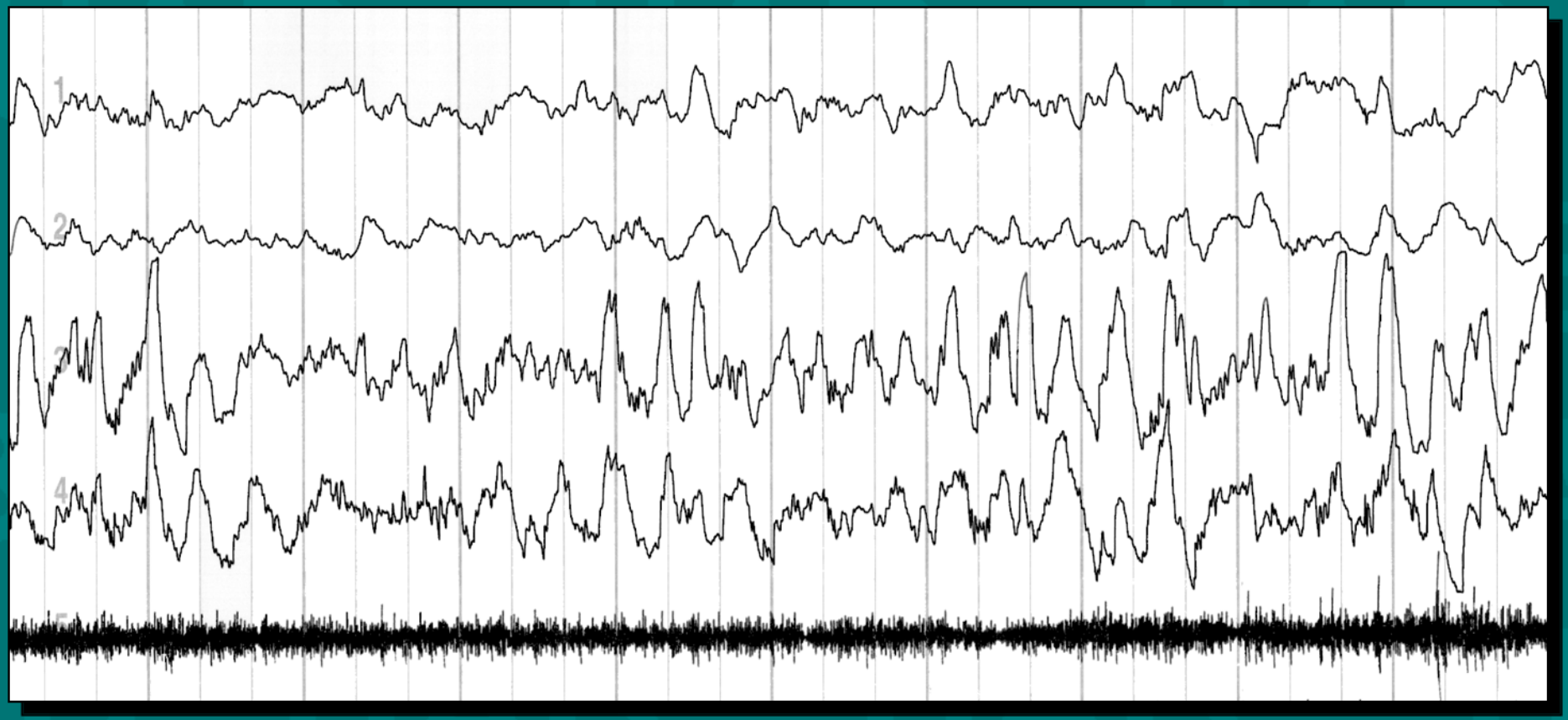
- Guess the correct answer to the following questions. Press the space bar to see the answer.
- HAVE FUN



Stage Wake

What stage is this?

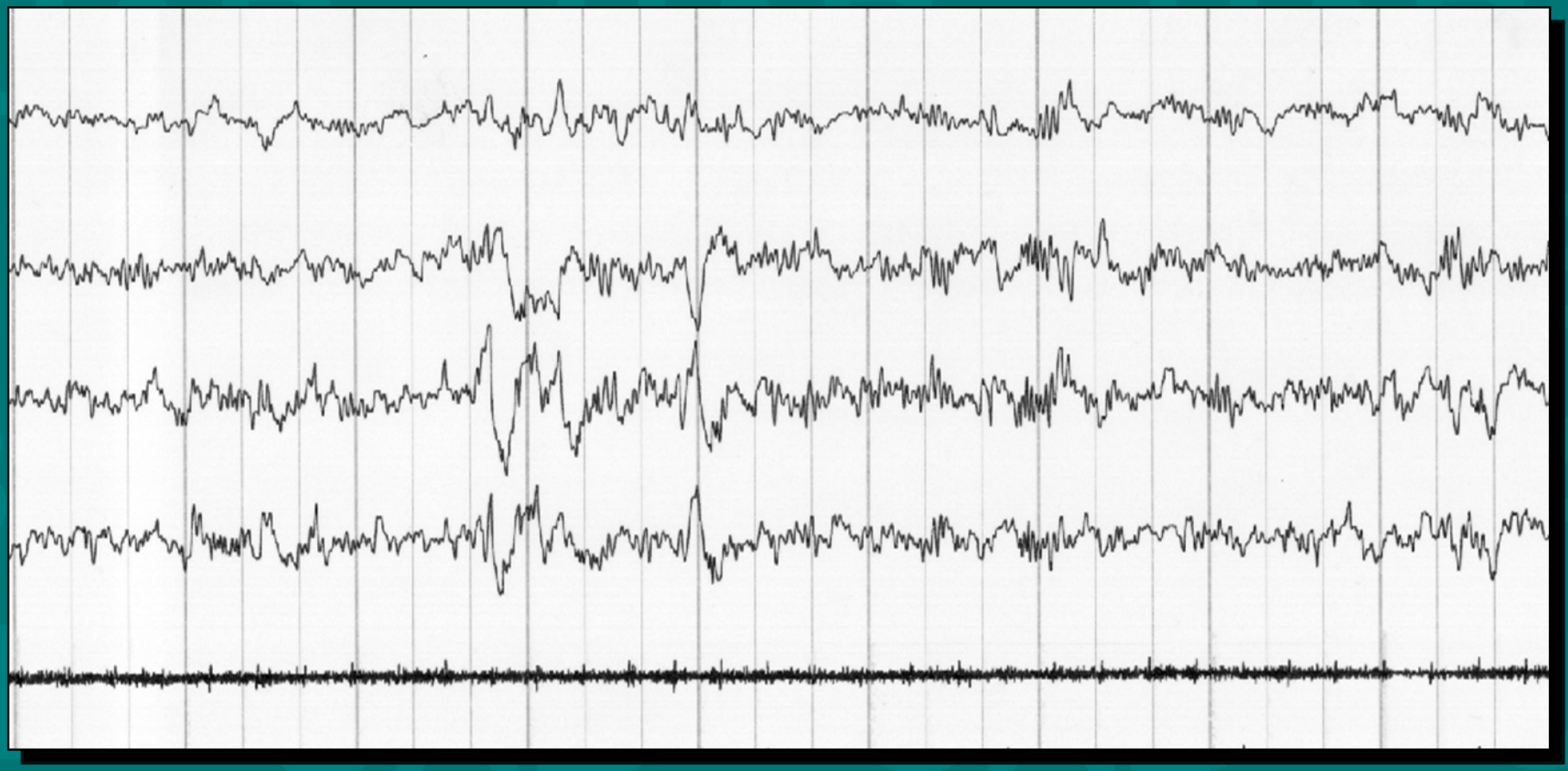
A. Stage 2
B. Stage 1
C. Stage Wake
D. Stage REM



Stage 4

What stage is this?

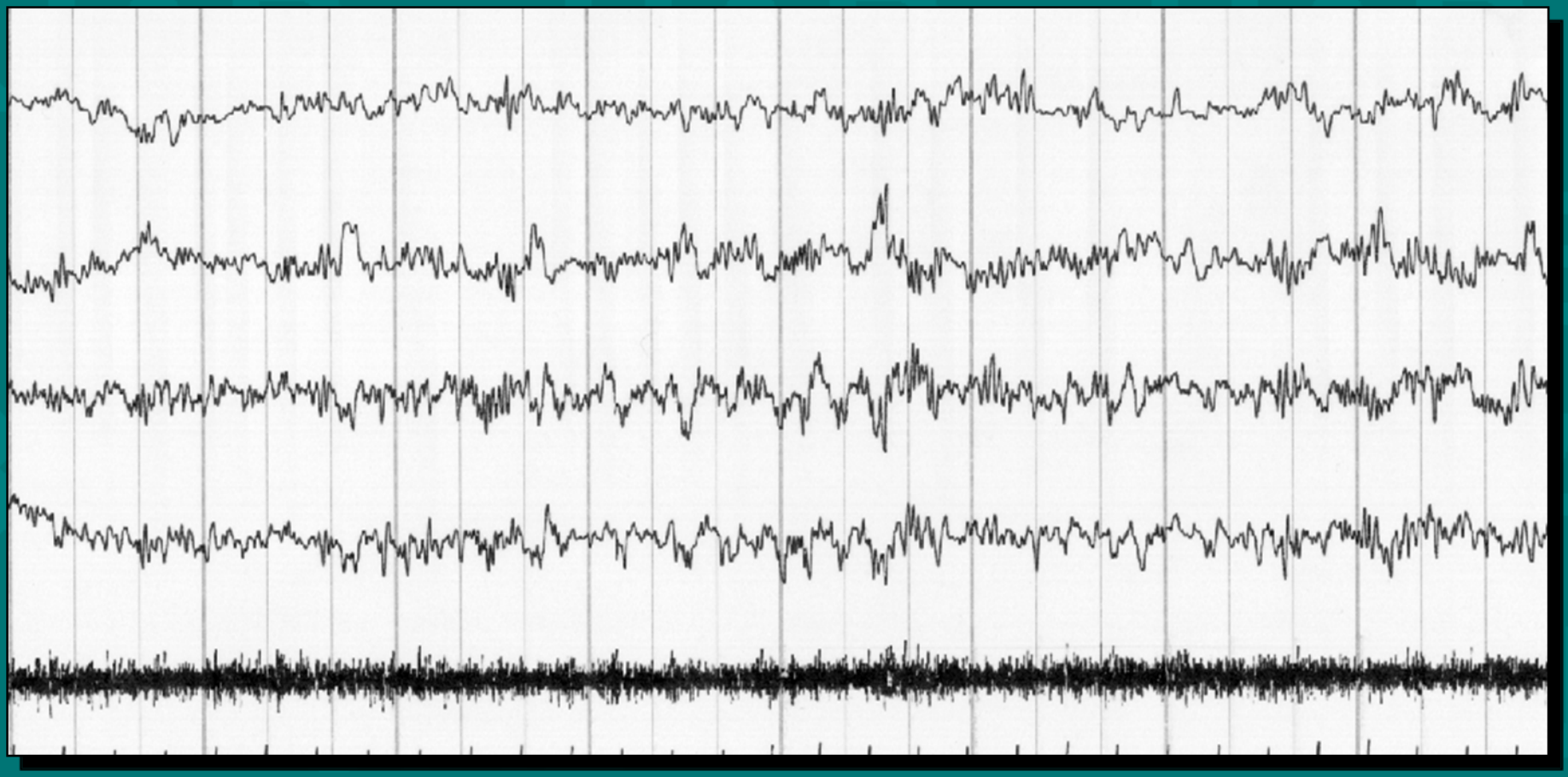
A. Stage 2
B. Stage 3
C. Stage 4
D. Stage REM



Stage 2

What stage is this?

A. Stage 2
B. Stage 1
C. Stage Wake
D. Stage REM



Stage 2

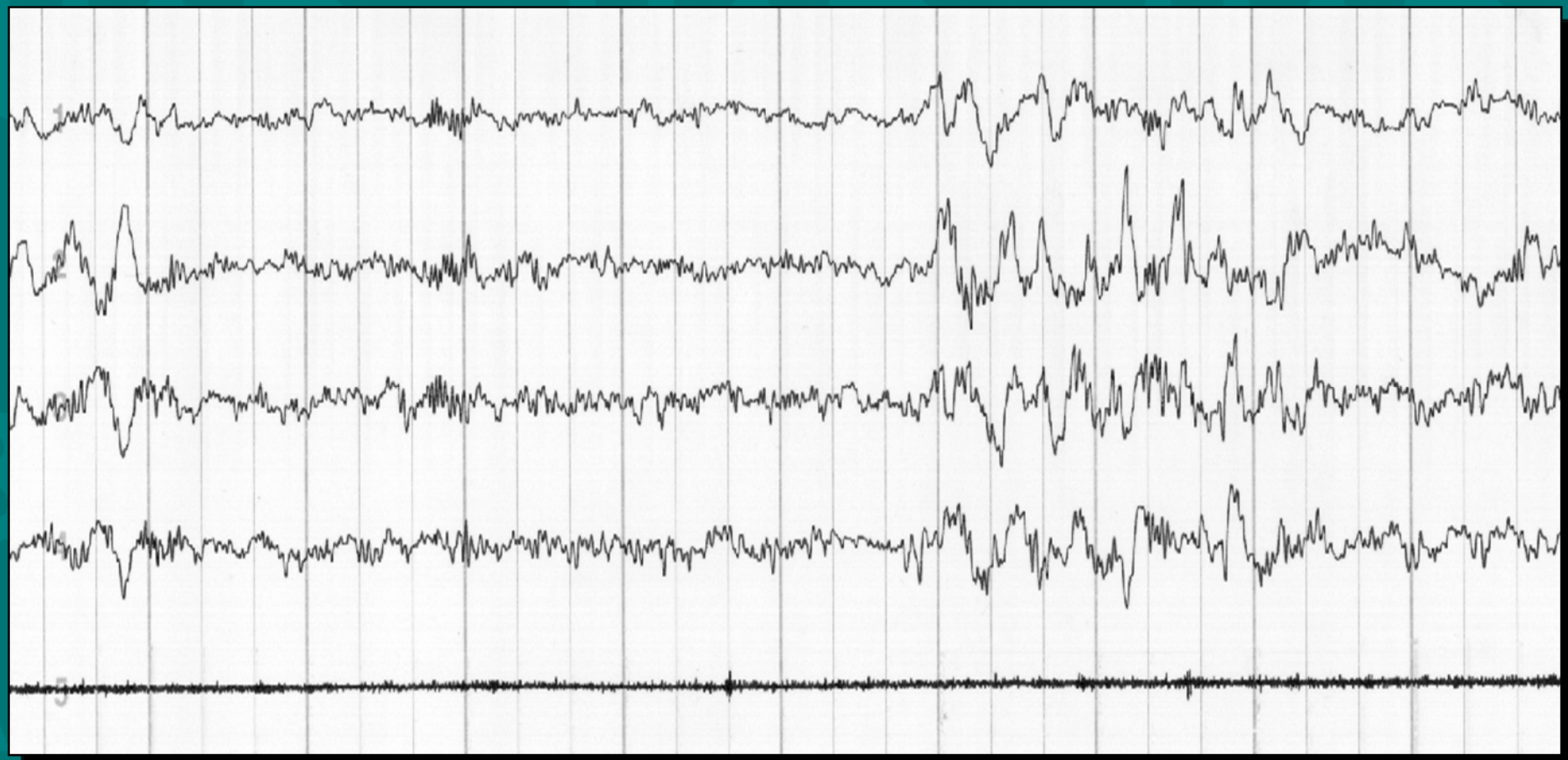
What stage is this?

A. Stage 2

B. Stage 1

C. Stage 3

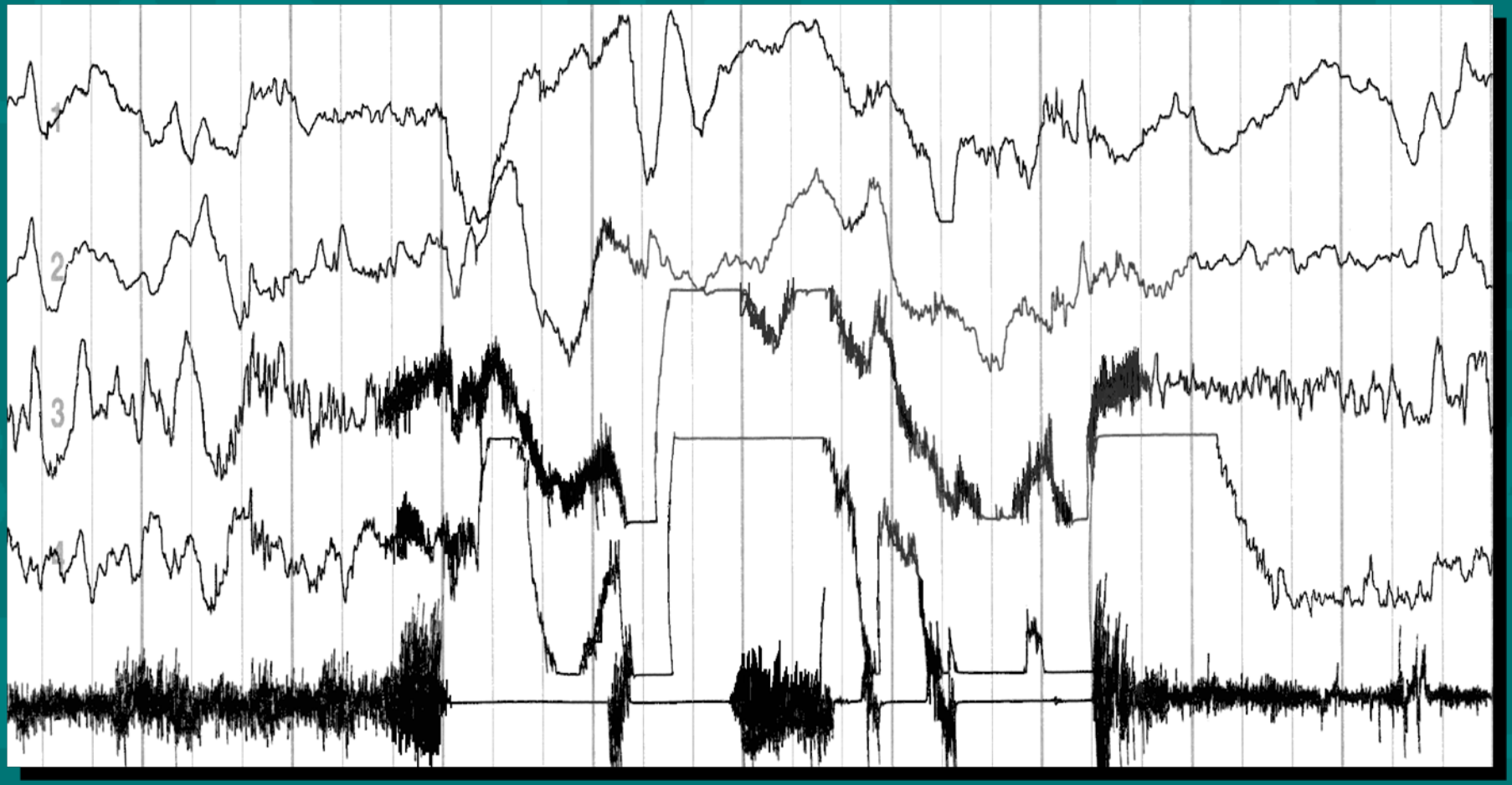
D. Stage REM



Stage 2

What stage is this?

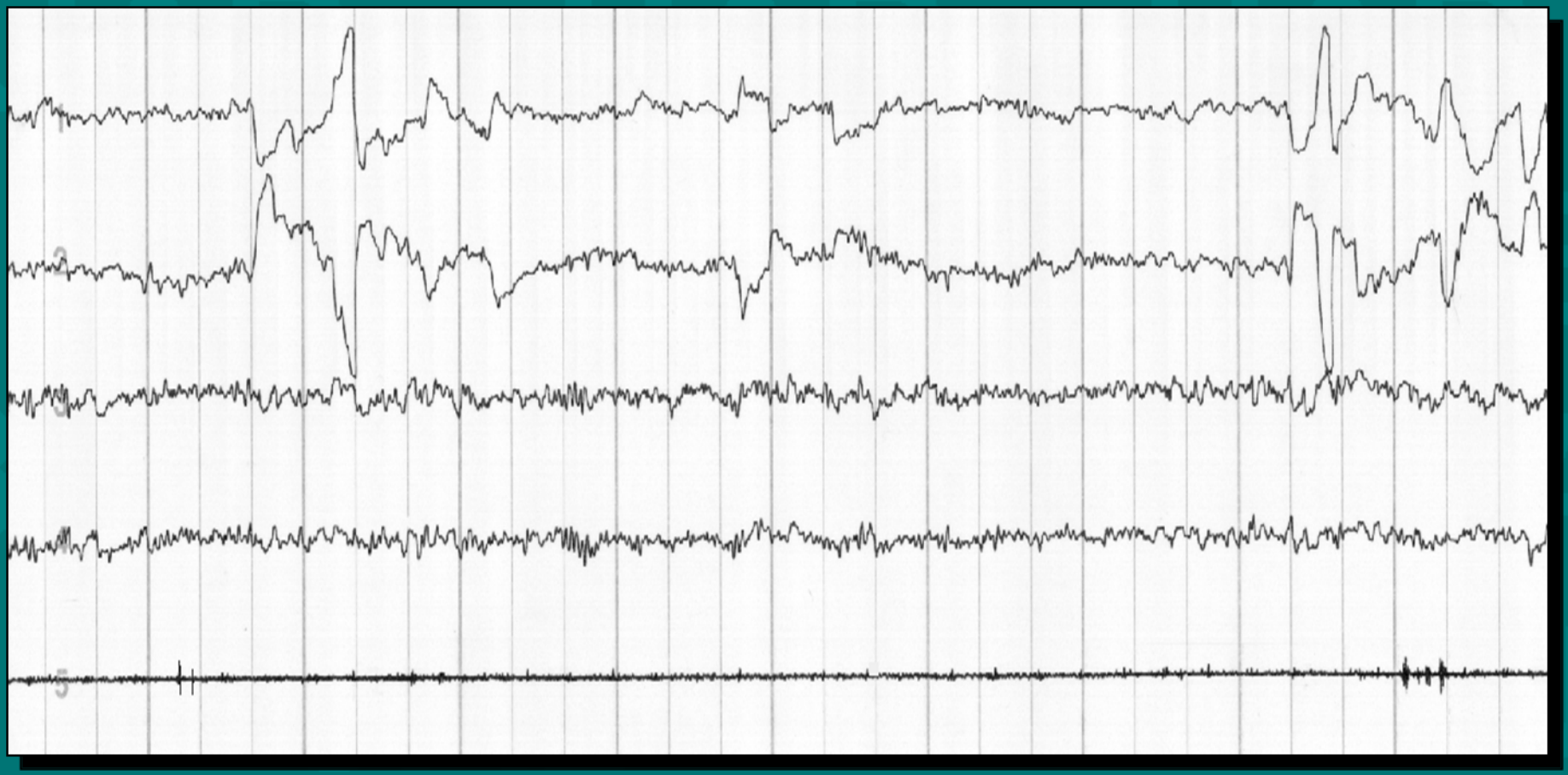
A. Stage 2
B. Stage 3
C. Stage 1
D. Stage REM



What stage is this?

A. Stage 2
B. Stage MVT
C. Stage Wake
D. Stage REM

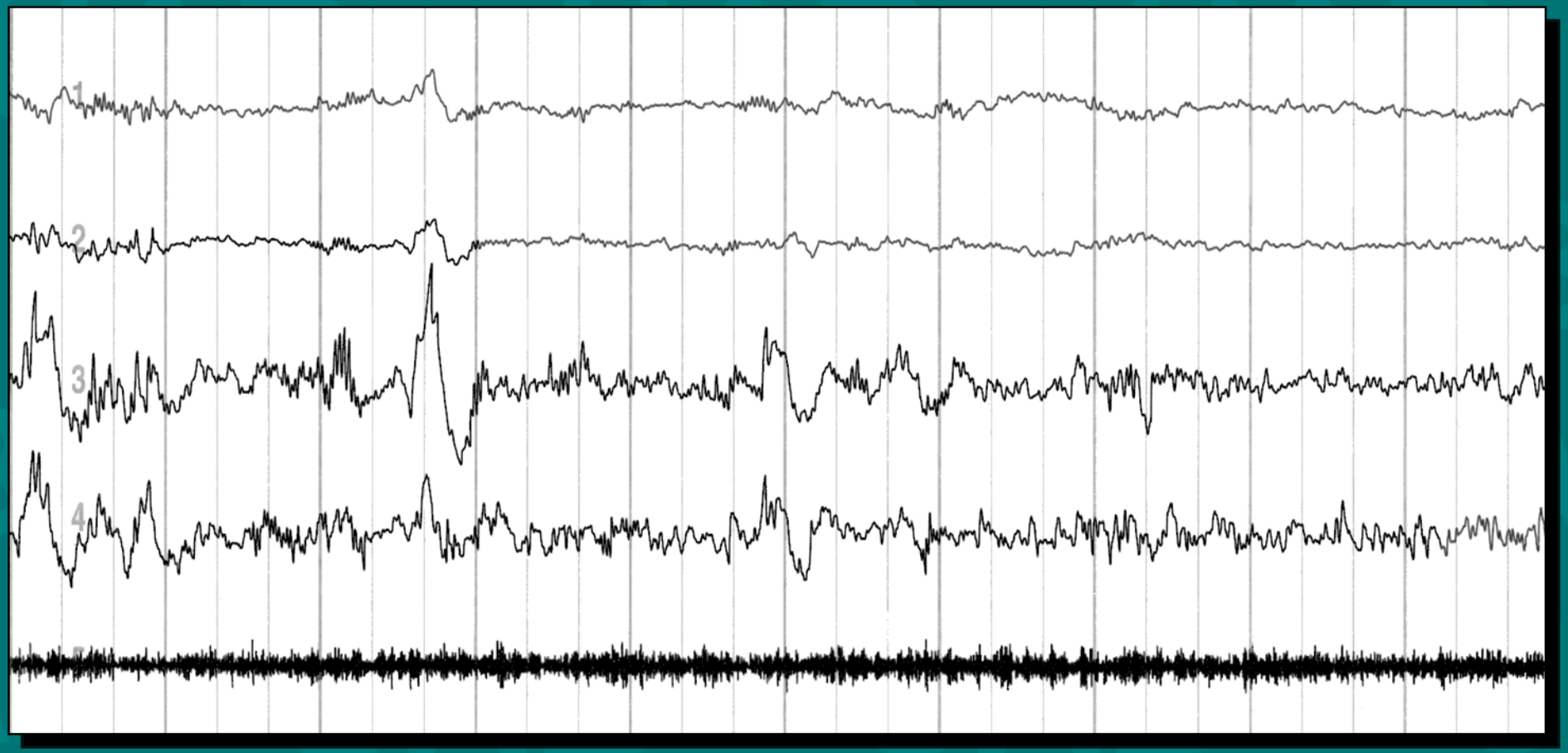
Stage MVT



Stage REM

What stage is this?

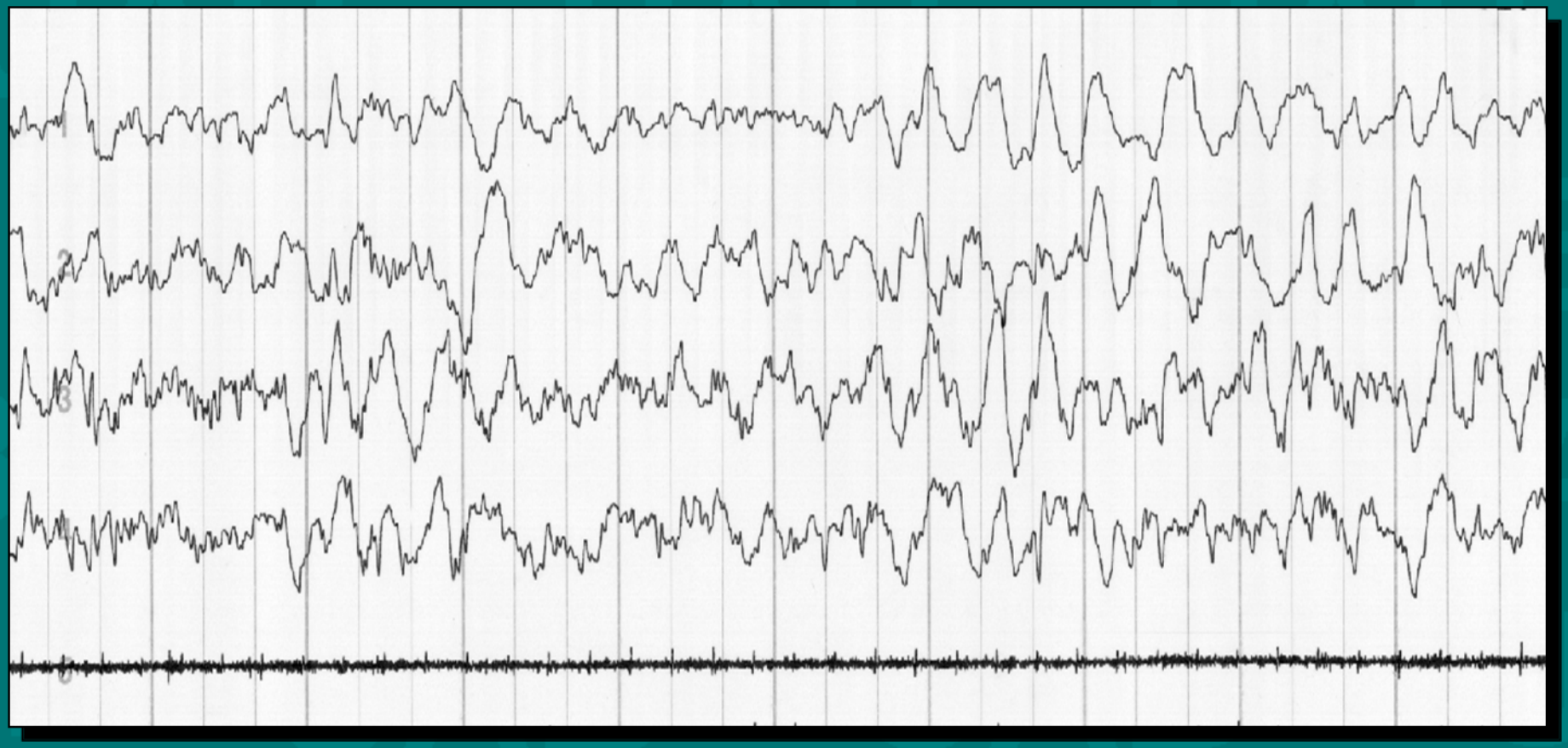
A. Stage 2
B. Stage 1
C. Stage Wake
D. Stage REM



What stage is this?

A. Stage 2
B. Stage 1
C. Stage Wake
D. Stage 3

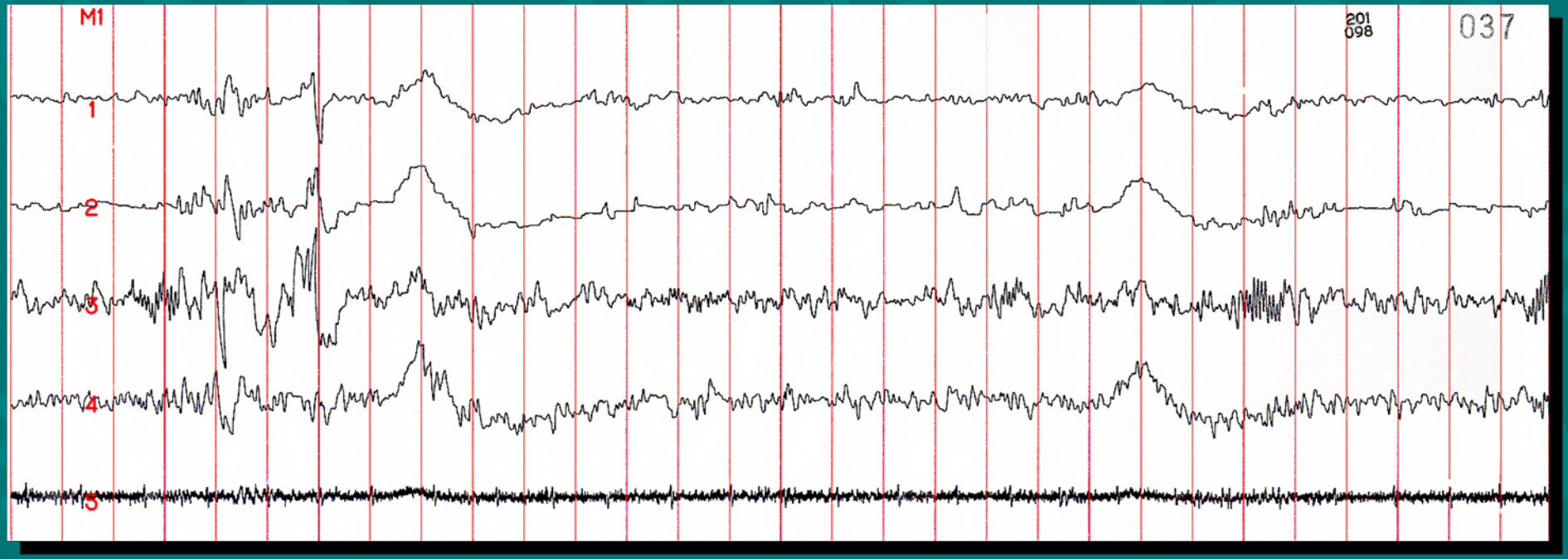
Stage 2



Stage 3

What stage is this?

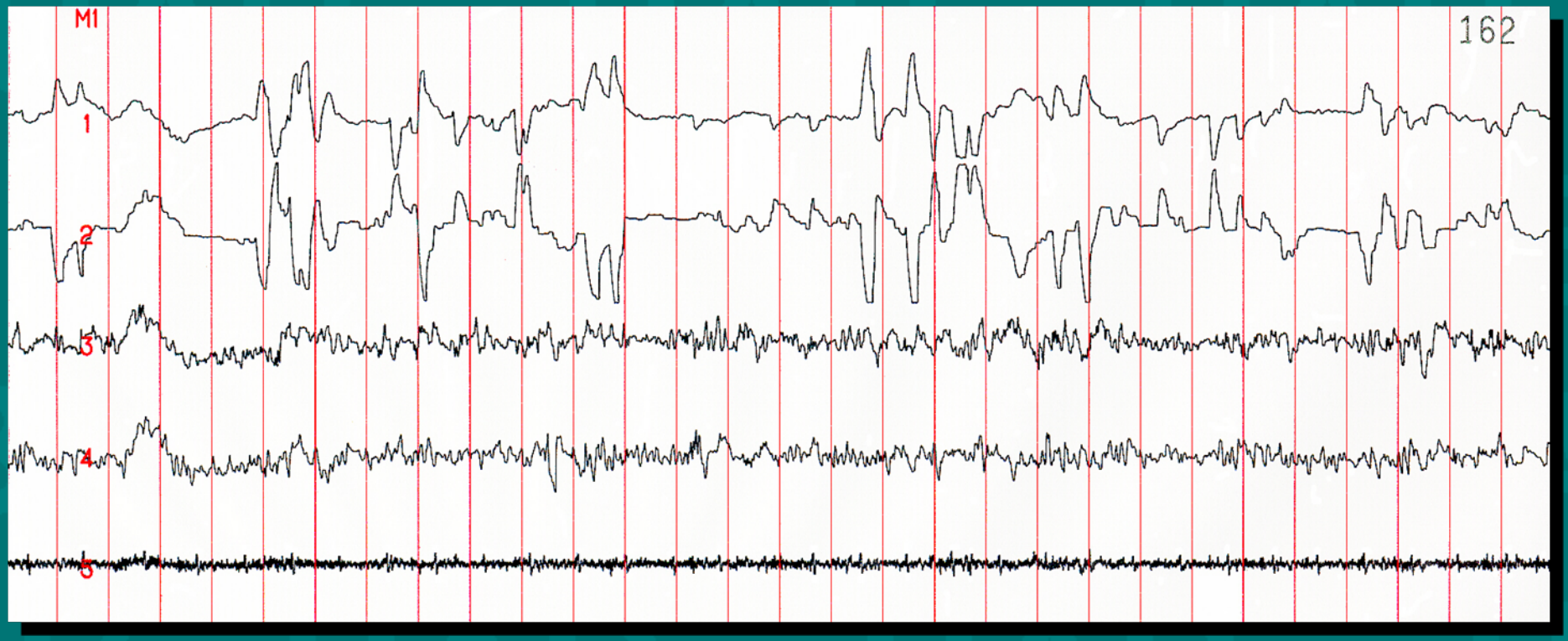
A. Stage 2
B. Stage 3
C. Stage 4
D. Stage REM



Stage 2

What stage is this? Why?

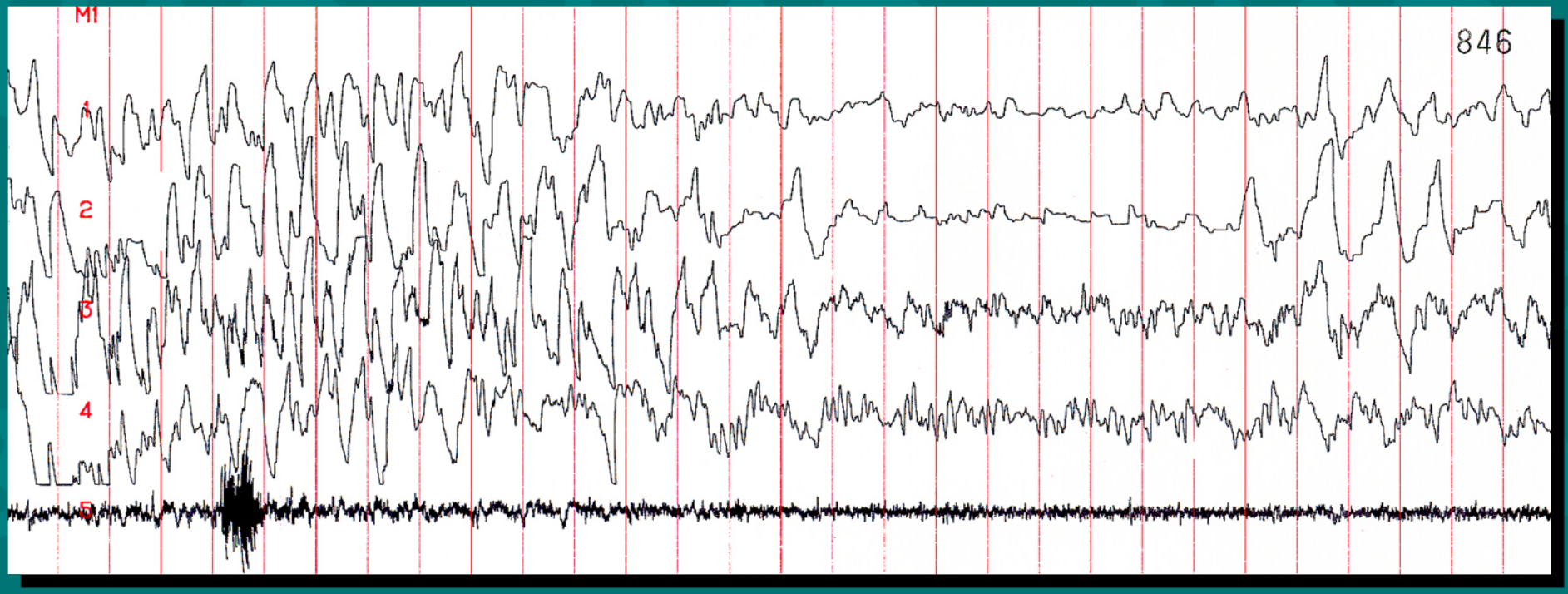
A. Stage 1
B. Stage 2
C. Stage 3
D. Stage REM



Stage REM

What stage is this? Why?

A. Stage REM
B. Stage 4
C. Stage 2
D. Stage Wake



What stage is this? Why?

A. Stage 4
B. Stage 3
C. Stage 2
D. Stage REM

Stage 3

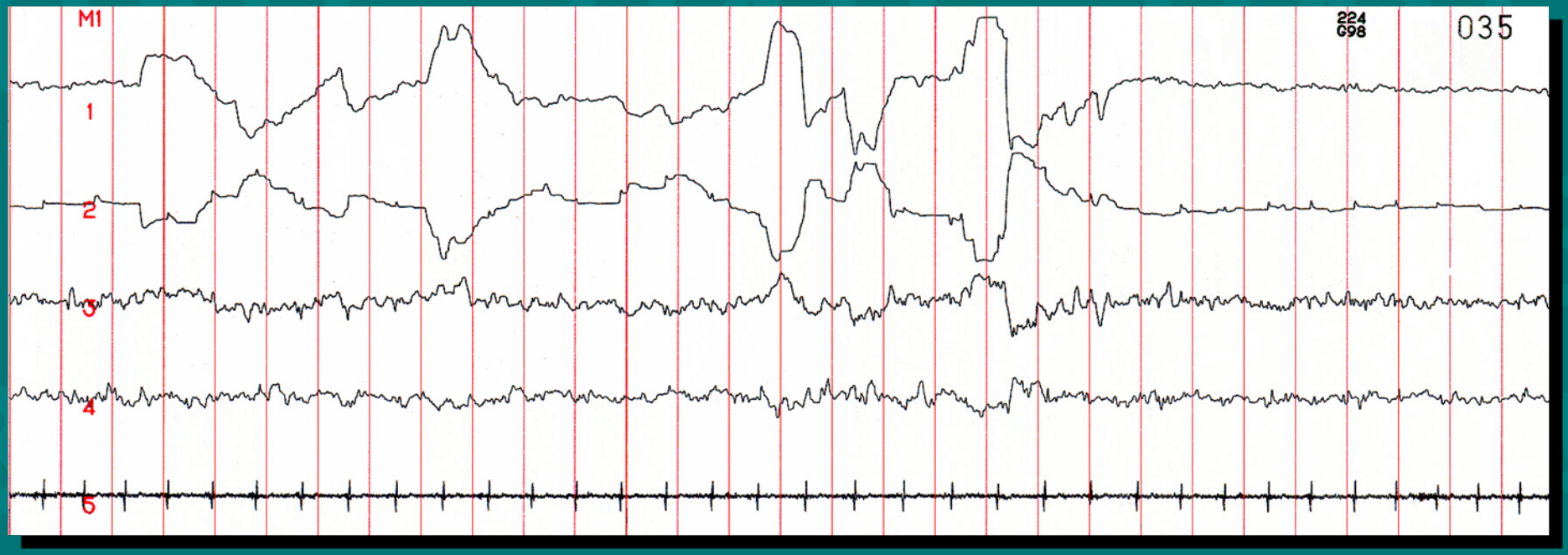
The frequency is too fast for Delta (in most of this epoch).

What stage is this?

A. Stage 2
B. Stage 1
C. Stage Wake
D. Stage REM

Stage 1

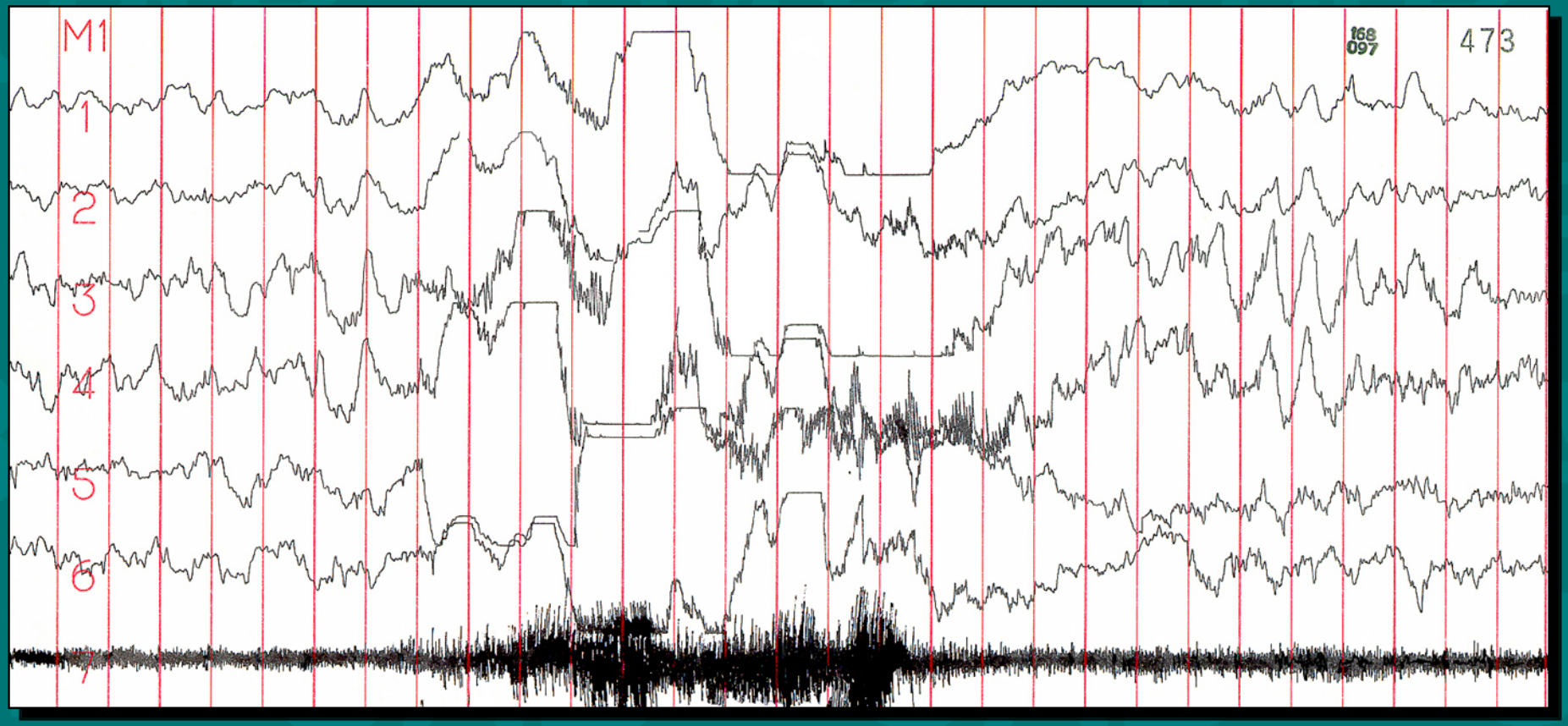
No K complex or spindles are seen.



Stage REM

What stage is this?

A. Stage 2
B. Stage 1
C. Stage Wake
D. Stage REM



What stage is this?

A. Stage 2
B. Stage 1
C. Stage MVT
D. Stage REM

Stage 2

The activity in the center of the tracing isn't long enough for MVT